SMARTPHONES FOR ONLINE STUDY: EFFECTS ON LEARNING AND ENGAGEMENT

Thesis submitted in accordance with the requirements of the University of Liverpool for the degree of Doctor of Education by

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LIST OF ABBREVIATIONS

FCC	Federal Communications Commission
FRAME	Rational Analysis of Mobile Education
GPA	Grade Point Average
IOREC	International Online Research Ethics Committee
LTE	Long Term Evolution
LMS	Learning Management System
LSD	Least Significant Difference
SRS	Student Response System
SCEQ	Student Course Experience Questionnaires
STEM	Science, Technology, Engineering, and Mathematics
TAM	Technology Acceptance Mode

ABSTRACT

Online classrooms and online learning have proliferated as smartphones have become ubiquitous. The combination of developments relating to the efficacy of online learning and the use of smartphone as tools to gather and process information have raised questions about the impact of smartphones on higher education. Smartphones have become more and more a part of our daily lives. The smartphone has been an especially critical component of the lives of teenagers and young adults. It is as important to have a smartphone as it once was to get a driver's license. In the United States, the Department of Education brought forth a motion that allowed children to bring their devices in to schools. Many of the officials had no doubt in their minds that this would facilitate effective learning.

Past research indicates that students are willing to embrace the use of smartphones in their learning. Based on current statistics, even economically disadvantaged students are able to access smartphones, though they may not have access to other gadgets such as laptops and Internet connections at their homes. According to scholarly literature, smartphones become a tool for learning the moment they are used to take pictures as notes and record videos when conducting interviews. Smartphones also have many other qualities that make them useful for learning: connectivity, portability, interactivity, and individuality.

This study investigated differences in the way students approach online learning, comparing those who use smartphones, rather than mobile devices more generally, to access their online classroom and students who use more traditional tools, such as desktop and laptop computers, to access their online classroom. This study used a mixed-methods research design to investigate the use of smartphones and their effect on learning behaviors and engagement in online education at a regionally accredited US institution. The study examined quantitative aggregate and latent qualitative differences in relation to the effects smartphone devices have on students' approach to learning and engagement when these devices are used as a means of accessing and studying through an online learning management system. The study found statistically significant differences in the ways students approach their own learning using their smartphone to log in to their learning management system and students who used other

technological mediums to sign in to their learning management system. The study also found statistically significant differences in engagement patterns, albeit conflicting results have been found in comparisons between online students who indicated using their smartphones to log in to the learning management system when compared to students using desktop computers or tablets. The study also revealed that the type of tasks online students perform with a smartphone varies significantly from the tasks that students perform when using a desktop or tablet.

Keywords: learning management systems, smartphone, online education, learning behaviors, student engagement

Statement of Original Authorship

The work contained in this thesis has not been previously submitted to meet requirements for any other award or credit at this or any institution of higher education. To the best of my knowledge, the thesis is wholly original and all material or writing published or written by others and contained herein has been duly referenced and credited.

Signature: Bret Miller

Date: July 16, 2018

Table of Contents

LIST OF FIGURES

LIST OF TABLES

CHAPTER 1 INTRODUCTION

1.1 Background

The use of smartphones has radically changed over the last decade. This decade has also witnessed unpredictable and life-changing innovations in the cell phone industry. The education sector has not been isolated from these developments. E-learning has become a common phenomenon in schools, with most institutions supporting a distance or virtual mode of learning in which learning takes place with minimal or no physical interaction between the student and the instructor (Marcovitz, & Janiszewski, 2015). The impact of technological devices on the learning styles of students remains under-explored. In a recent development, e-learning has been replaced by "m-learning," which mainly utilizes mobile devices, which demands a comparative inquiry of learning affordances of smartphones as opposed other device types (Kim, & Yoon, 2014). Many would assume laptops and other forms of portable personal computers to be the most common mobile devices employed, but in the first decade of this century the use of smartphones has grown at a rate almost ten times that of computers, which increases the future importance of m-learning (Wang, 2017).

Koller, Harvey and Magnotta (2006) pointed out that technology-based learning (TBL) has a number of benefits, even though they also indicated that applying the technology might be difficult, such as due to non-learning-related uses. This reflects previous literature which points out that institutional investment in infrastructure and course design may inhibit the potential benefits of m-learning and smartphone use that may demand a methodological adjustment of distance learning offerings to these platforms (Magnotta, 2006). Though according to Koller et al. (2006), TBL is eminently adaptable to the utilization of smartphone technology, this remains to be validated empirically.

Nevertheless, in the United States, the Federal Communications Commission (FCC) published the *National Broadband Plan*, suggesting how important cellular Internet access could be, particularly in education, as smartphones may help address unmet educational needs (FCC.gov, 2010). This report specifically addressed education, acknowledges that the workplace

today and, in the future, requires a different set of work skills; workers will need to be not only better educated but also differently educated. Another recommendation of this report suggested that government agencies should fund wireless connectivity to portable learning devices. This report also recommended that these devices should be allowed to be taken from the campus, so students can learn, and educators can plan, outside of normal educational hours (FCC.gov, 2010). In other words, according to this report (FCC.gov, 2010), mobile devices are likely to represent a novel channel of learning materials' delivery outside of the classroom.

The smartphone industry has seen considerable growth in the use of these mobile devices in learning online in that period. Smartphone usage has significantly contributed to the proliferation of online classrooms. This proliferation of online classes and online learning has led to concerns among higher education instructors and administrators about the connection between active involvement of students in learning and the use of technological enhancements, as recreational uses of smartphones may reduce the time budget dedicated to learning in off-campus environments (Offir, Lev, & Bezalel, 2008). Moreover, the ubiquity of smartphones and their widespread acceptance as information-gathering tools evoke questions about how smartphones are affecting online learning and how their development has assisted learning in various ways, since the impact of these mobile devices can be both positive and negative (Boyd, 2014).

Fonseca et al. (2014) noted that 1.5 billion mobile phones were available for the world's population of six billion people, suggesting that one-quarter of the global population had access to a cell phone. This was before the roll out of 3G telephones, which substantially increased the number of phones in operation. Worldwide, half of all employees have been found spending up to half their time working from locations outside their regular office, and the use of smartphones to execute various duties was found to become increasingly crucial for a wide variety or educational and other purposes (Fonseca et al., 2014).

Previous studies on the effect of ubiquitously available computing capabilities such as via handheld mobile gadgets—for example, smartphones and tablets— on student learning have indicated a need for further research into this topic, due to both rapid changes in the

functionality and affordability of smartphones and the wide variety of empirical findings, methodological approaches and eventual conclusions which qualify the expected positive influence of m-learning on student-level outcomes (Chan, Walker, & Gleaves, 2015). In other words, in scholarly literature no consensus exists on whether smartphones can be efficiently integrated into mobile learning solutions (Chan, Walker, & Gleaves, 2015). In recent years, reports and studies have found smartphones to be typical among middle and secondary school students. In 2012 a broad survey of 5,600 US high school students found that 34% possessed an iPhone, an high share significantly exceeding the earlier years' rate. Additionally, 40% of those reviewed alluded to plans to buy a smartphone within the following six months (Elmer-DeWitt, 2012). Thus, whether educators desire it or not, smartphones are set to be making part of the learning environments of the overwhelming majority of high school and university learners across socio-economic groups in the years to come (Elmer-DeWitt, 2012).

Nothing better outlines the mobile phone use pattern and expanding pervasiveness of these computationally powerful gadgets than the "noteworthy point of reference" that worldwide smartphone expansion overwhelmed global aggregate offers of PCs across all customer classifications (netbooks, note-books, and desktops) in 2011 by a wide edge—487.7 million to 414.6 million units respectively (Duggan & Smith, 2013; West, 2013). This makes smartphones into an increasingly important digital learning platform (Duggan & Smith, 2013; West, 2013).

However, worldwide, smartphone sales have expanded by 7% from 2015 to 2016, reaching 1.5 billion items, whereas the mobile phone market has been estimated to reach 1.9 billion of units sold, according to yearly trade reports (Sahoo, 2016). Therefore, these findings indicate that in 2016 smartphones represented approximately 78.94% of all mobile phones sold in that year. In 2016, global shipments of both personal computers (PCs) and mobile computing devices, such as phones and tablets, have been reported to demonstrate a year-on-year increase of 0.6%, reaching 2.4 billion units. This can be contrasted with a decline of 1.5% in worldwide PC shipments of 14.8% (all classifications) in the same period. There was a further decrease of 6.7% in the sales of traditional PCs and a decline of 3.4% in the shipments of tablets in 2016 (Sahoo, 2016). Thus, there is a likely developing disengagement between today's well-informed students and their university’s overall perceptions, practices, and instructional

methods concerning innovation in the classroom (Kumar, & Sharma, 2016; Pascarella, Seifert, & Blaich, 2010). Additionally, the saturation of the global smartphone market also indicates that they have become ubiquitous accessories that have eclipsed personal computers in their importance as information delivery channels (Kumar, & Sharma, 2016; Sahoo, 2016).

There is a possible divergence between classroom administration arrangements and the robust capability of these gadgets. In addition, a developing assemblage of research has found that smartphones and short message service (SMS) and other messaging services can decidedly affect student learning by encouraging synchronous community-oriented learning, giving a foundation to the conveyance of instructional substance, and providing a way to survey student learning and cooperation and to develop best teaching practices on that basis (Guevara, 2015). This mobile framework has been utilized in ways that affect student learning inside and outside of classrooms, even though recent studies indicate that integrating smartphones into in-class and mobile learning environments can be challenging, due to possible distractions, lacking skills and technological requirements (Anshari, Almunawar, Shahrill, Wicaksono, & Huda, 2017; Lin, Shao, Wong, Li, & Niramitranon, 2011). This indicates that smartphones can be better suited for meeting some learning objectives than other ones (Anshari, Almunawar, Shahrill, Wicaksono, & Huda, 2017). Yet specialists have perceived the potential for these gadgets to encourage joint effort and expand learning openings by encouraging an all-around adoption of mobile devices, such as when strolling, on the road, on the public transport, and at the school premises (Sánchez & Olivares, 2011). This is especially relevant to efforts made to exploit the educational potential of mobile devices as learning and teaching platforms in sciences and other disciplines, which justifies drawing an empirical sample from across a student body at a representative university for a study of m-learning (Ekanayake & Wishart, 2015).

A few specialists have even proposed that mobile handheld gadgets may bolster student learning more than conventional desktop PCs as a result of remote availability, versatility, and relative ease, with transformative effects on learning processes across various organizational and technological contexts (Middleton, 2016; White, 2006). On the basis of these discoveries, analysts have encouraged further exploration of mobile phones and their capacities in instruction as digital didactic aides for both younger and older students, since they can facilitate

independent, student-centric learning that encourages knowledge sharing, collaborative learning and discussions (Markett, Sánchez, Weber, & Tangney, 2006; Woloshyn, Bajovic, & Worden, 2017). The ability to take and send pictures has implications too:

> "Due mainly to advances in cognitive science, researchers today increasingly recognize that we do indeed have the capacity of thinking directly with images, without verbal mediation" (Nyíri, 2002, p. 3)

even though the impact of country-level or cultural contexts on these processes only begins to be investigated (Al-Shahrani, 2016). Moreover, the exploration of student-side effects of m-learning remains nascent and is likely to be context-dependent, as far as the validity of empirical findings is concerned (Woloshyn, Bajovic, & Worden, 2017).

1.2 A Brief Historical Overview

As pointed out by Fonseca et al. (2014), highly specialized pedagogical technologies involved in learning and teaching processes are not as successful in distance education as are technologies that are readily available to the average citizen. One example of this is the 12" laserdiscs that were popular in the 1990s. A few classes were developed that could be used by individuals who owned a disc player. Language classes were particularly suited to this mode of delivery (Fonseca et al., 2014). The problem was that not enough people owned these devices, and they were not very convenient as they depended on the availability of electricity, a player, and a monitor. By contrast, these limitations do not apply to smartphones that have enjoyed high rates of consumer adoption (Fonseca et al., 2014).

One of the issues that was not addressed, but will be mentioned briefly now, is the difficulty in keeping up with new technological developments. In Keegan's (2005) analysis, the technological world was in the process of transitioning from 2G to 3G. Qualcomm (2014) traced the history of cell phone evolution. 1G services, which licensed telephones and cell towers, established frequencies, and developed rudimentary mobile networks, were developed in the 1980s. There was limited scalability, the equipment was expensive, and even the number of calls available on the spectrum was limited. The 1990s saw the evolution of 2G, which led to far more voice capacity on the networks. Qualcomm (2014, p. 10) describes 2G as "more people, in

more places." The system allowed scalable technology. In other words, as opposed to earlier-generation mobile phones, smartphones can support highly scalable educational solutions and can handle high volumes of real-time data transmission (Qualcomm, 2014).

In the early 2000s, some of the technical problems that had plagued 2G were solved, and the networks expanded to 3G, or data-optimized mobile broadband. It was during the 2G phase that engineers and educators began to perceive that phones could be used for education. As 3G became the norm and network access became common, smartphones led e-learning into m-learning and stimulated interest in the possibility of taking a class while lying on a lounge at the beach. By the year 2010, smartphones contracts as portable devices of choice became the norm in the pocket-held technology sector in the United States. These developments made the location of the students and the instructors, to some extent, irrelevant, as mobile devices became ubiquitous. Thus, global access to mobile technology means location-independent access to one's study partners (Kukulska-Hulme & Shield, 2008). These technology development trends have unfolded their impact to a growing extent over the last decade, while increasing their amenability for m-learning (Qualcomm, 2014).

In 2010, 4G, a new standard for wireless, broadband and mobile communication called Long-Term Evolution (LTE) debuted (Qualcomm, 2014). This technology was faster than mobile broadband, allowed high data capacity, and was advanced enough to allow students to take classes at the same time as they listened to music and texted friends. This is not the end, however. It is expected that by the beginning of 2019, 5G will be ready as part of the technological advancement in the world of Internet use. The pace of technological development is increasing, and universities will need to be prepared to upgrade their equipment and media at a similar rate. Aasmae (2016) revealed that field tests in Sweden show that 5G will be 40 times faster than LTE. The inference being, that content-delivery models of educational and other institutions are likely to be significantly disrupted by the growing location independence of rich-format information consumption (Aasmae, 2016).

According to Keegan (2005), the advent of 3G (3rd generation) network speeds brought about convenient time management capacities such as the ability to utilize waiting room and public transportation time to do work or to study, the ability to run computer programs on a

smartphone, to access the Internet through wireless capacity; to pay one's bills (including tuition) by phone; and to communicate with others face-to-face through various applications. Keegan (2005) pointed out the advantages of portable devices as against desktops. These include reduced expenses, increase in battery life, growing storage, constant always-on connectivity, an increase in functionality; video capabilities, high definition TV, digital radio, wide software choice, voice recognition capabilities, global tracking systems, miniature size, scientific calculation abilities, recording functions and assessment uses (Keegan, 2005; Olivier, 2011).The utilization of 3G and 4G is likely to ensure faster and efficient access to the Internet brought about convenient time management capacity (Keegan, 2005; Qiang, 2009). In short, these devices added mobility and wiped out some usual formalities in service delivery. Likewise, ever higher Internet speeds coupled with constantly evolving smartphone technology can make mobile phones into preferred platforms for learning and other uses (Olivier, 2011).

The structure of many US and UK pricing plans has made it as inexpensive to purchase significant amounts of data as small amounts of data, and hotspots are widely available, even in some rural areas. Keegan (2005) points out that the advantages of 3G service, which at the time was the highest technology available, included:

> "handhelds rather than desktops; decreasing costs; increase in battery life; increase in memory; constant always-on connectivity; increase in functionality; video; high definition TV; digital radio; software as for desktops; voice recognition; global tracking systems; size of devices; scientific calculation; recording of evidence and assessment" (Keegan, 2005, p. 2).

The future, as Keegan (2005) and Fonseca et al. (2014) stated, was wireless. Keegan's (2005) research indicates that young people, particularly aged 16–24, consider a mobile phone to be a necessity. In Europe, Keegan (2005) has found, all students enrolled in European institutions of higher education tend to have a mobile phone. With the international generalization of Keegan's (2005) findings, as the ubiquity of mobile devices continues to rise, this thesis seeks to analyze the effects smartphones, based on new digital technologies, have on learning and various forms of education. For these reasons, high schools and universities

may need to increasingly take into account smartphones as one of the possible platforms through which their educational systems will be accessed by students (Fonseca et al., 2014).

Keegan (2005) included mobile phones and smartphones in his definition of m-learning, since these devices are small enough to be carried everywhere, due to their user friendliness and amenability for personal computing, as later studies on the uses of mobile devices in educational contexts for access to learning materials and professional information also confirm (Burgerová & Adamkovičová, 2016). Moreover, students can be assumed to hold largely advanced models of smartphones that can support a wide variety of recreational and educational uses, such as the utilization of social networks for education program information access (Burgerová & Adamkovičová, 2016).

In his research, Keegan (2005) conducted a meta-analysis of previous studies that concentrated on students that all had mobile phones, which is relevant for this research. His secondary conclusions indicated that governmental agencies developing programs with classes that the youth could "attend" on their mobile phones are likely to find that reluctant learners can be motivated to utilize such projects provided the presence of appropriate mobile learning material design. In previous studies it has also been found that young people who had jobs that did not allow scheduling class time and youth who did not have tabletop PCs all wanted to participate in a phone-based m-learning project (Keegan, 2005). Particularly due to the non-educational uses of smartphones, m-learning can, thus, increase the inclusivity of education (Burgerová & Adamkovičová, 2016).

There were four initial projects in Europe, funded by the European Commission in Brussels. The first was *From e-learning to m-learning*, headed by Keegan (2005). The project, which explored the creation of class work for mobile phones, personal digital assistants (PDAs), and smartphones, found that students liked the process, and memory problems could be solved with PDAs at the time, but that not enough students had PDAs throughout the world (Keegan, 2005). Though at that point in time device memory was an issue with mobile phones, this no longer represents a limitation to the context-independent deployment of m-learning solutions (Burgerová & Adamkovičová, 2016).

Another salient project was the *M-learning* project, led by the Learning and Skills Development Agency (Attewell, 2005) of the United Kingdom's government (Yuen, Duan, & Yuen, 2010). The project was particularly of interest because it addressed youths aged between 16 and 20 years, who were not only unemployed but who refused to go to classes, training, or college. The Learning and Skills Development Agency (LSDA) determined that this group all had mobile phones. The agency developed programs that the youth could "attend" on their mobile phones and found that the reluctant learners utilized the project. They also found that young people who had jobs that did not allow scheduling class time and youth who did not have tabletop PCs all wanted to participate in the phone project (Keegan, 2005). This indicates the amenability of m-learning solutions to the online delivery of education programs across different demographic and socio-economic groups (Yuen, Duan, & Yuen, 2010).

While there is an increasing amount of research on mobile learning, there has been an insufficient amount of research specifically investigating university students' approach to learning and engagement patterns of online learning as affected by the use of smartphones, since particular educational solutions, e.g., mobile gamification platforms, tend to be empirically examined on a case-study basis, rather than using research designs exploring interrelations between learning-related variables per se (Su, & Cheng, 2015). This gap provides this study with a rationale to inquire into the effects that information available via the smartphones has in relation to learning.

1.3 The Research Context

The research context involves the use of smartphones to sign into their Learning Management System by undergraduate students in the online courses of a single regionally accredited US university. At the time the study was conducted, the researcher and author of this thesis served as a research manager for the above-mentioned university's Department of Institutional Effectiveness. The university was considering allocating resources into developing a mobile app that would allow online students to seamlessly access their online classroom without needing to manually sign in through a browser on their mobile device. The researcher

first posited to the university's leadership to allow him to investigate how the use of smartphones in the online classroom may affect the university's online students in their engagement and individual approaches to learning behaviors. This research would benefit both the university in adding additional context before allocating precious resources and the researcher in his pursuit of an EdD.

Online education is a well-established approach for students who do not physically attend classes but nonetheless have a learning experience analogous to that in a traditional classroom (Park, Nam, & Cha, 2012). Moreover, the use of smartphones for regular communication and information-gathering activities is a social trend that appears to be gaining momentum in the United States. Smartphones are becoming increasingly important in our day-to-day lives, due to their versatility as mobile computing devices (Park, Nam, & Cha, 2012).

It is prudent, therefore, to identify the effects of their applications in aspects of learning and general engagement. Existing evidence from research also suggests that students who are accustomed to using smartphones, in general, have a positive attitude toward using smartphones for mobile learning (Rung, Warnke, & Mattheos, 2014). Consequently, a positive attitude toward the use of smartphones could lead to higher student engagement when it is possible to use the smartphone to access the LMS, which is an important factor for achievement in individual courses and retention of students in online programs, even though this needs to be examined in relation to m-learning (Milligan, Littlejohn, & Margaryan, 2013).

A significant aspect of the use of smartphones in online education is their ability to support the use of different learning approaches for students. Some students may prefer to learn the material in brief components that are frequently repeated; an approach smartphones can support. Some students may also have time constraints because of work or other commitments, which require them to access the online Learning Management System (LMS) when they have available time regardless of their physical location. In practice, whereas smartphone technology is flexible enough to support varied approaches to learning, particular device types, such as smartphones or tablets, can be more supportive of accomplishing specific educational tasks than others (Kukulska-Hulme & Traxler, 2005).

Colleges and universities have an opportunity to develop online learning programs that can support student use of smartphones, which can enhance the learning experience. To provide students with apps and other technology necessary to use the smartphone, however, colleges and universities must understand the differences in factors such as engagement and learning outcomes. There is, however, substantial uncertainty concerning the best ways for colleges and universities to incorporate the use of smartphones in their online courses and LMS, which this study seeks to remedy (Kuo et al., 2015).

The research reported here sought to investigate approaches to learning and engagement differences between online students accessing their learning management system via smartphone devices compared to online students accessing their learning management system through other tools such as computers or tablets. For this study, "approach to learning" is defined as studying intentions and motivations. This research also uses the typology of approaches to learning developed by Marton and Säljö (1976) as well as Purdie, Hattie and Douglas (1996), e.g., a tactical approach and a strategic one. On the other hand, "engagement" is defined as the extent of time, commitment, resources, and intentional student-to-student and student-to-instructor proactive involvement that students contribute toward their learning (Krause & Coates, 2008). The study sought to derive data on the use of smartphones and their effects on learning behaviors and student engagement in online education at a single higher education institution.

1.4 Rationale and Significance of the Study

The rationale for the study was to fill a gap in current knowledge concerning the way that students use smartphones to participate in online courses and to interact with the LMS. Because of the gap in knowledge, which is explained more in Chapter 2, colleges and universities do not have sufficient information to inform the development of approaches to improve accessibility to online courses with smartphones. Consequently, this study may help instructors and information technology staff at colleges and universities by providing information about smartphone use that can lead to improvements or usability changes in the

LMS. The findings of the study may also have significance for a more general understanding of the technological factors as well as the specific devices that affect student concentration and commitment to learning. The information may be useful for expanding the role of the smartphone as well as other mobile technologies in online education.

1.5 Terminology

Definitions of terminology are included in this section if they might reasonably be expected to vary from common usage. Thus, the terms are defined in ways specific to this research and may not apply to other documents.

Distance education. Distance education is all planned learning that occurs at a place different from teaching and requires specialized technology for course design, instruction, and the ability of students to access the course content (Reyes, 2013).

Learning management system. A learning management system (LMS, or virtual learning environment, as it is sometimes called) is software designed for delivering, tracking, and managing education; it can include software such as Moodle, used to deliver courses over the Internet, which supports online collaboration (Mahnegar, 2012).

Mobile learning. Mobile learning is learning supported by handheld, portable computing devices, including smartphones; it can include both formal and informal learning, regardless of where the student is situated (Gikas & Grant, 2013).

Smartphone. A smartphone is a mobile telephone that runs with an operating system and is permanently connected to the Internet, which permits interactive communications (Yu, 2012).

1.6 Overview of the Thesis Structure

Supplementing the information provided in the first chapter, Chapter 2 contains a critical review of scholarly literature, and identifies the gaps in existing knowledge on the

subject of the present research. Chapter 3 discusses the mixed-methods research approach of this study aimed at addressing the research questions and includes the rationale for its methodology, for the data collection using the survey questionnaire and focus groups, and for the data analysis approach. Chapter 4 presents the results of the study and is separated into sections discussing the quantitative and qualitative findings. Chapter 5 discusses the findings considering the research literature, answers the research questions based on the findings, and analyzes the study's general and practical implications. The conclusion analyzes the information gathered in terms of its value to day-to-day activities in the education sector.

CHAPTER 2 LITERATURE REVIEW

2.1 Introduction

The rationale for the present research is based on past studies indicating that the use of smartphones as a mobile computing device has increased substantially over the past several years, with many online students preferring to use the device to obtain course content and to interact with instructors and peers in online course offerings (Yu, 2012). Consequently, this chapter provides an overview of the advantages of mobile technologies for online students. These advantages include the ability to engage in learning activities from nearly any location, since the improved LMS accessibility, combined with the ubiquitous nature of the cell phone, can lead a change or increase in engagement-specific tasks which help increase student engagement (Khatib et al., 2011). At educational institutions, the administration or instruction staff's lack of support for applications which would utilize the device in the learning environment may affect the way students use smartphones in online courses (Shukla, & Shinde, 2016), since social, technological and individual-level constraints for online learning can exist (Song, & Kong, 2017).

This chapter critically reviews the research literature relating to the use of mobile technology as an educational tool. It begins with a general review and discussion of definitions (2.2) to help familiarize readers with the ideas presented in existing literature, followed by a general examination of the content related to mobile learning (2.3). Then, an in-depth review of previous relevant projects is included (2.4), mobile learning (2.5), and student engagement in m-learning and e-learning environments (2.6) before an overview of transactional distance theory (2.7). Next, various aspects of mobile learning are reviewed (2.8), followed by information about learning management systems, specifically how they interact with the use of smartphones (2.9), leading to an examination of student learning approaches (2.10) and the impact of digital technology on learning approaches (2.11). Finally, a summary is provided which discusses this study in relation to the literature that has been reviewed and ends with identifying the gaps in the literature (2.12). The review is structured to ensure a systematic and in-depth coverage of all the areas of relevance previously covered by scholars and researchers.

Smartphones have become reliable and ubiquitous so that understanding how mobile learning behavior might affect students' approaches to learning and engagement in the online environment will increasingly become important to higher education institutions. In recent years, the use of mobile computing devices has proliferated on a wider scope, in most parts of the world. Across all age groups, individuals are using the devices for multiple purposes when away from their primary computing devices. These mobile computing tools provide educational opportunities for students in online education programs to access course content and to interact with instructors and peers regardless of where the student is located (Gikas & Grant, 2013).

The proliferation of mobile devices has acted as a catalyst for the development of a new form of online learning known as mobile learning (m-learning) (Squires, 2014). The concept of mobile learning can include learning through mobile terminals such as smartphones, learning by students who are on the move, and learning through mobile content, anywhere and anytime (Prieto, Miguelanez, & Garcia-Penalvo, 2014).

Some researchers have found that student usage patterns for accessing online learning platforms has steadily increased from 1.42% of users accessing the learning management system (LMS) from a mobile device in 2009 to 19.55% in 2013 (Hernández & Pérez, 2014). Usage has increased because mobile learning permits access to information at any time from web-enabled devices typically used for social purposes but able to convert to educational purposes (Fuegen, 2012). Consequently, the availability of the technology may be gradually changing the behaviors of students in the learning process, specifically in their approach to how they receive and synthesize educative information and in their level of engagement.

Smartphones are now the primary type of basic mobile computing device used by students in higher education worldwide, although students continue to use other devices such as tablets (Yu, 2012). Students use smartphones when away from computer terminals to remain connected with a social and educational environment. Smartphones have the capability to interface with an LMS while allowing the student to download numerous apps that can be beneficial in the learning process. Smartphones also have the capability to provide information

in different formats such as text documents, audiovisual media, and connections to social media platforms. Students use their smartphones in very personal ways, considering them a link with social networks and with a wide range of information sources and formats, such as text messaging (Vazques-Cano, 2014).

The smartphone has the potential to provide a variety of benefits for learners taking courses online, such as the ability to engage in independent and collaborative learning experiences, the ability to obtain rapid feedback from instructors, and the ability to engage in informal learning at any time (Fuegen, 2012). In addition, the smartphone can provide students with more rapid access to content in situations where they cannot easily use an alternative approach to access the LMS (Vazques-Cano, 2014). The smartphone can also facilitate the feedback process that is fundamental to successful distance learning by allowing students to obtain feedback at any time regardless of physical location (Mahnegar, 2012).

The effectiveness of the smartphone for supporting distance learning often depends on the range of apps available for the smartphone that the course supports (Kim & Yoon, 2014). As a recent study among Australian university students indicates, a lack of custom-developed apps and online materials that could be integrated into the course and easily accessed, navigated and interacted with by students on their mobile devices can be a significant barrier to the use of smartphones by learners (Farley et al., 2015).

The importance of apps for the mobile learning process suggests that the potential benefits of the smartphone can only be realized if the technology architecture of the online course is designed to incorporate apps that the students perceive as useful for learning. In practice, policies adopted by a college or university concerning the use of mobile devices and the interface with the LMS can have a significant effect on the ability and willingness of students to use smartphones (Vazques-Cano, 2014). As alluded to by Charles (2012), the way students conduct themselves with smartphones in learning scenarios depends on the degree of mutual trust and respect, rather than rules set to govern behavior by learning institutions. Therefore, one may expect scenarios where the set code may be ignored in the course of an engaged learning process.

Applications are small-scale, particular and downloadable programs for mobile gadgets that perform much the way software packages do on conventional PCs (Misra et al., 2016). There are local, online, and cross-breed applications. Apps and the platform interface can also influence how useful students perceive the smartphone for accessing the LMS. The willingness of individuals to use an available technology depends on their proficiency with the technology and their perception of the usefulness of the technology (Chang, Yan, & Tseng, 2012). Because smartphones are ubiquitous, the general assumption is that online education students have the necessary skills to use smartphones. However, universities should not make an undifferentiated assumption that all students possess smartphones. Consequently, the decision to use a smartphone for various online learning activities depends on the perception that the smartphone will be useful for performing learning tasks. If the institution does not have sufficient apps to allow full access to the LMS, the student is less likely to use the smartphone because the student will not find substantial utility for the device in the online learning process (Shin, Shin, Choo, & Beam, 2011).

A significant problem can arise with the use of mobile computing devices such as smartphones in the educational process when the educational institution does not fully grasp the manner in which students use these devices. A negative attitude of administrators and instructors toward the use of smartphones in online courses may also be a factor that can contribute to the insufficient understanding of the manner in which students would prefer to use smartphones in education (Kukulska-Hulme & Traxler, 2005). Consequently, the design of courses intended for online education might omit key elements such as apps for smartphones or the ability to support online submission of work using common word processing software such as Word (Viberg & Gronlund, 2015). Educational institutions need to develop apps for smartphones that are specific to the needs of the course and the LMS, which can, however, increase the cost of developing online courses (Vazques-Cano, 2014).

2.2 Definitions

In extant scholarly sources, there is no consensus about how to define key terms in the study of mobile learning or in any of the related fields of study. There is a significant overlap in the ideas presented in various areas of research. As a result, key terms are discussed in the following sections, to explore their use in scholarly literature.

The concept of learning as a social activity is related to a constructivist theoretical framework. From this perspective, learning is socially constructed (Bruner, 1996; Vygotsky, 1978). Collaboration helps building knowledge, since students interact. Given that students interact, they can collaborate. Once collaboration has developed, as this perspective argues, then knowledge construction can begin. Various types of interaction build on the previous level of interaction in much the way that scaffolding occurs, since each part of knowledge acquisition builds on the previous parts (Roblyer & Wiencke, 2004; Vygotsky, 1978). Yet, students gain information not only from each other, but also from the instructor. They share information in the process of two-way communications, regardless of the mode of communication. Each student brings his or her own perspective to the collaboration and further informs the learning process (Bruner, 1996; Vygotsky, 1978).

The constructivist perspective prescribes support and guidance from more educated others if learning is to result in increased knowledge production. Peers can also create knowledge together through an exchange of ideas. This is the process of scaffolding, which refers to the process in which a teacher or someone with more knowledge about a given subject models how to solve a problem or complete a task for the learner (Cohen et al., 2010). Scaffolding allows a student to solve a problem or achieve a goal that is above the level that they would be able to accomplish without the assistance of these more knowledgeable others. According to Vygotsky (1978), the Zone of Proximal Development (ZPD) is the area between the student's knowledge and that of the scaffolding others. The ZPD is the area in which an increase in knowledge occurs (Cohen et al., 2010).

Vygotsky (1962) argued that learning processes involve the recognition of the information and material to be learned through pattern identification and recognition, the

application of information processing strategies as part of learning-related actions, planning and processes and the engagement in learning tasks that is likely to be influenced by affective or emotional factors. Thus, online learning environments can also promote these learning processes, due to their immersive nature, such as in game-based learning systems (Varonis, & Varonis, 2015).

Furthermore, recent studies indicate that Vygotsky's (1978) ZPD theory is a descriptive framework, rather than an explanatory approach to improving student performance in learning contexts (Murphy, Scantlebury, & Milne, 2015). Moreover, past studies have indicated that the ZPD theory primarily emphasizes the interactive character of learning in the process of students' educational development (Murphy et al., 2015).

While Vygotsky's (1962, 1978) and Bruner's (1996) theories have been traditionally applied to early learning, they have a great deal of applicability to adult learning as well. Most importantly, they suggest that much learning takes place "in collaboration with more capable peers" (Vygotsky, 1978, p. 86) and by building on what has already been learned (Bruner, 1996). This suggests that to expect students (of any age) to learn completely on their own would be less effective for most people.

Constructivist theory is particularly applicable to the various types of e-learning and m-learning (Kashi, 2016). The main premise of the constructivist theory is that "knowledge is constructed in the learner's mind through interaction with the environment and people to get experience" (Kashi, 2016, p. 26). In other words, as students interact, they build new concepts based on the ones that they already know. Gradually, the learning process increases the knowledge base of the individual (Harman & Koohang, 2005).

Constructivist theory is not related to instruction. Rather, it is a theory of learning. It is "the belief that the learner is active in shaping how new knowledge is taken in and shaped" (Ng & Nguyen, 2006, p. 41). Constructivist theory is associated with three strategies. First, learners construct knowledge as part of their individual and unique learning. Second, learning experience represents the transition between what learners know and what they want to know (Kashi, 2016, p. 27), or the ZPD (Vygotsky, 1978). Third, according to Vygotsky (1978),

interactions between learners are closely integrated into knowledge construction processes. Another way of phrasing this is that knowledge is actively constructed. Students read or study, they ask questions of other students and instructors, and they begin to make sense not only of what they are studying but also of the world that impacts the subject manner that they are learning, and vice versa (Neo, 2007).

There is more than one type of constructivism. Social construction, or learning through the actions not only of self but of more knowledgeable others, is one type. Cognitive constructivism is another. According to Doolittle and Hicks (2003), cognitive constructivism is related to working memory, computational learning, and other mechanical functions. It includes language theories, learning strategies, and learning how to solve problems. Both social constructivism and cognitive constructivism are applicable to e- and m-learning; they have a great many commonalities and both involve the concept of communities of learners who instigate learning through the interaction of less knowledgeable learners with more skilled learners (or instructors) (Rowell & Palmer, 2007). Again, this reflects Bruner's (1996) concept of scaffolding and Vygotsky's (1978) ZPD.

According to Dalgarno (2001), the third type of constructivism may be pertinent to this research. Radical constructivism supports the concept that knowledge is constructed from a combination of what one learns intellectually, and what one experiences. Von Glasersfeld (1998) argues that this type of learning is essentially self-developed; it suggests that knowledge is the result of learning and experience. In Johnson's (2014) view, the differences between the three types of constructivism are related to the support of cognitive constructionists for the idea that learning is an individual or independent venture. By contrast, as Kashi (2016) summarizes, social constructionists support the idea that learning is a social activity that takes place in the presence or with the assistance of more knowledgeable others, whereas radical constructivism suggests that people construct knowledge from experience. Combined, they present a picture of the learner who can learn through self (radical constructivism), experience (cognitive experience), or through the assistance of others (social constructivism). Taken together, they present a cogent model of learning in an e- and m-learning situation. When the three forms of constructivism are regarded as being interactive, rather than mutually exclusive,

m-learning becomes a viable and dynamic form of learning that harnesses all three forms (Kashi, 2016; Swan, 2005).

These theories are interrelated and can be used to support the m- and e-learning processes, since they all support the notion that learning is not a passive action, in which the instructor feeds the student the information, who then digests and repeats it (Kashi, 2016).

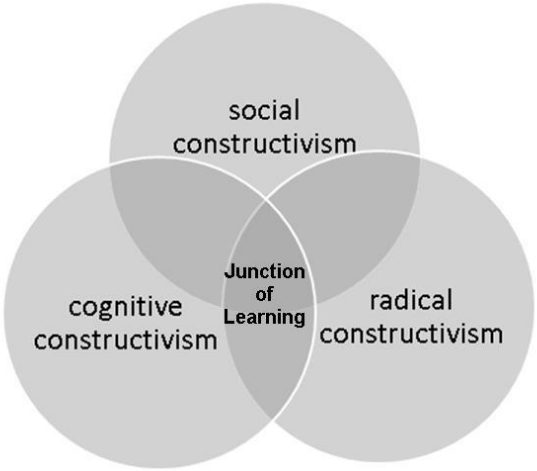

Figure 1. Junction of Learning.

(Source: Researcher)

The junction of learning as shown in the figure above is an inter-relationship among social constructivism, radical constructivism, and cognitive constructivism (Johnson, 2014; Harman & Koohang, 2005; Kashi, 2016; Rowell & Palmer, 2007; Swan, 2005).

2.3 Transition from e-learning to m-learning

Students, but not necessarily schools, are making a transition from e-learning to new m-learning skill levels (Caravello, Jiménez, Kahl, Brachio, & Morote, 2015; Georgiev, Georgieva, Smrikarov, 2004). E-learning can be generally characterized as materials intended for access through electronic correspondence, for example, the Internet, intranets, synchronous, and non-

concurrent modules (Crescente & Lee, 2011). M-learning develops the idea of e-learning further by adjusting its substance to handheld gadgets, and it can thus be characterized as learning with mobile gadgets anyplace and at any time (Crescente & Lee, 2011).

This capacity to absorb learning any place and whenever implies that learners can never again be impeded by whether they possess non-mobile devices like a desktop PC (Crescente & Lee, 2011; Marcovitz, & Janiszewski, 2015). It has also been recommended that since note-book PCs are not mobile devices they should not be classified as genuine m-learning gadgets (Crescente & Lee, 2011). M-learning offers benefits over conventional learning methods and e-learning in that data is available anyplace and gadgets are increasingly convenient. In addition, m-learning is also similar to e-learning, as in the framework of both pedagogical approaches information can be consistently refreshed, communication is immediate, cooperation can be synchronous, and proficiency (particularly mechanical skills) can be enhanced (Ozdamli, 2012). In a similar vein, Woodcock et al. (2012) suggested limiting the definition of a mobile learning device to something that is small enough to put in a pocket or purse, justifying this limitation saying that “in the definition of *mobile* learning the focus should be on mobility of the devices” (p. 96).

The ability of mobile gadgets to download and host what is, for all intents and purposes, an unlimited number of specific, small programming bundles known as "applications" makes these gadgets inherently adaptable as learner-focused apparatuses. The applications’ usefulness can go a long way past correspondence and photography. Local mobile applications utilize the local programming dialect for their operating environment, for example, Objective-C for iPhone or iPad or Java for Android (Witecki, & Nonnecke, 2015). Local applications are quicker, interface with clients better, and utilize all gadget highlights. One drawback is that they can be utilized only on a particular range of devices, in this manner confining their usability (Witecki, & Nonnecke, 2015).

Web applications are mounted on Internet websites utilizing purpose-built programming dialects, for example, HTML5. They take after regular software applications, and can be accessed through mobile programs (Witecki, & Nonnecke, 2015). Despite the fact that

web applications can be utilized over a multiplicity of environments and gadgets, they are not acknowledged in the device-specific application stores—restricting their conveyance. Additionally, web applications cannot necessarily get to or utilize the local application programming interfaces (APIs) or some gadget-particular equipment highlights.

A middle ground in terms of cross-platform compatibility is occupied by crossover apps, which are fabricated utilizing web innovation and then wrapped in environment-particular shells. These shells make them look like local applications and make them qualified to enter application stores, however, they also enable engineers to work within constrained local functionalities; they allow engineers to access some local APIs and make use of certain gadget-particular equipment features (Witecki, & Nonnecke, 2015). The innate adaptability in having the capacity to download plenty of local, web, and cross- platform applications underscores the large potential of mobile gadgets to change instruction across a wide variety of academic subjects, such as science, technology, engineering, and math (STEM) courses (Banister, 2010).

Koller et al. (2006) describe the advantages of m-learning in relation to accessibility, having training capacity that is self-paced, scalability, the ability to be easily adapted to the latest up-to-date information, and a streamlined and effective learning delivery. Smartphone learning materials' delivery allows the student to study at any time, day or night. Depending on the curriculum design, it is self-paced; quick learners can progress more rapidly while slower learners can take their time. Classroom size limitations do not apply, and the systems can generally be scaled to add more users at relatively little cost. Instructors can update materials whenever there is a need. Finally, education programs can also be streamlined. For example, the University of Tennessee has been able to consolidate their Physicians Executive MBA program, which requires 14 traditional classroom courses, into a single technology-based program that takes only one year to complete, while using m-learning solutions (Koller et al., 2006).

Koller et al. (2006) also point out that mobile technology-based learning programs often have higher attrition rates than their non-mobile counterparts because students may not be self-motivated or engaged. Koller et al. (2006) refer to this issue as "'social loafing,' which

occurs when learners reduce their effort in TBL programs or are frustrated in their attempts to use TBL, because of the program's lesser focus on personal interactions" (2006, p. 8).

2.4 A closer look at m-learning

In her discussion of m-learning instructional methods and their pedagogical prerequisites, Muyinda (2007) referring to Sharples, Taylor, and Vavoula (2005) recognized essential elements necessary for the exploration of m-learning instructional method effectiveness, such as in terms of engagement. We must recognize, the authors argued, what is remarkable about m-learning contrasted with different sorts of learning; determine how to measure learning that happens outside of the classroom under the support of m-learning; consider contemporary speculations (for example, learner-centeredness, information-centeredness, appraisal centeredness, and group-centeredness); and represent the universality of individual and shared innovation (Muyinda, 2007; Sharples et al., 2005).

Likewise, Koole (2005) built a model for the rational analysis of mobile education to survey the viability of mobile gadgets for distance learning in light of constructivist ideas that learning happens through discernment and social communication (Crescente & Lee, 2011; Koole, 2005). This model can be represented by a following Venn diagram of three interlocking circles showing (A) gadget usability, (B) learner perspectives, and (C) social angles.

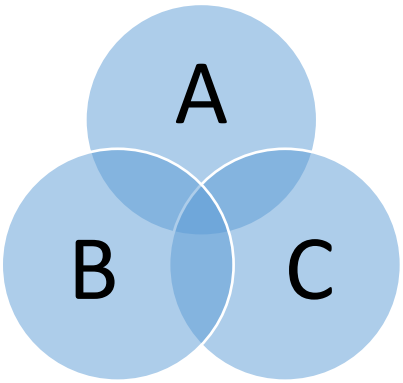

Figure 6. A model for the Rational Analysis of Mobile Education (Source: Researcher).

Gadget usability relates to the functionality of the mobile gadgets, learner and social angles allude to the personal abilities and earlier information of students, and social perspectives underline singular responses to societal conditions. Where all components converge, mobile learning becomes practicable (Crescente & Lee, 2011; Koole, 2005).

Ozdamli (2012) recognized four main areas important for a pedagogical system for mobile learning. These were a mix of apparatuses, academic methodologies, evaluation procedures, and instructor training. Hypothesis-based methodologies (for example, constructivism, mixed learning, collective learning, and dynamic learning) have been recommended as the premise of various m-learning teaching methods (Ozdamli, 2012). For instance, educators can use studio-based instructional methods with smartphones for socially meaningful technology-based and mobile classroom experiences:

> "During the place-based inquiry workshop, students used the built-in features of mobile devices (for example, audio recording, text messaging, GPS, cameras) and "off the shelf" software to investigate their city as a designed place. In order to introduce students to this concept and scaffold their initial investigations, we developed a simulation that invited them to role-play as consultants hired by the city to locate contested places and issues within the downtown area. As they walked around town in pairs, looking for, observing and analyzing contested places, the students used mobile devices to conduct interviews, take photos, access "just-in-time" information, and record notes" (Mathews, 2010, p. 89).

According to Zacharia, Lazaridou, and Avraamidou (2016, pp. 596-597),

> "mobile learning, a term commonly used to mean learning on the move […] takes place at any location and not necessarily in the classroom, and […] enables learners to access an information network by using a portable learning device and a wireless network."

Defining m-learning proves to be less simple than defining engagement and learning approaches more generally because there are a number of specific considerations that must be addressed in discussions of mobile learning. It is possible that it is not necessarily "mobile" learning if the device to be utilized is a desktop computer that could be moved within a short period of time. Gikas and Grant (2013) addressed this possibility when they pointed out that if

mobile learning is involved, there should be some mobility. Thus, while tablets, laptops, netbooks, cell phones, and even smart watches can be easily moved around, a desktop, even a small desktop, cannot be easily moved (Woodcock et al., 2012).

Regardless of m-learning's compatibility with theories of constructivist learning, a complex 21st-century mobile framework warrants a similarly refined instructional method—particularly one supporting utilization in all classrooms. The development of teaching methods for how to best utilize these gadgets in all classes remains empirically rather than theoretically oriented, as applied and methodology-oriented studies continue to predominate in this field (Duman, Orhon, & Gedik, 2015).

Before specifically defining m-learning, it is necessary to examine where m-learning came from. In this context, Denny (2013) has explored differences between the definitions of distance learning (d-learning), electronic learning (e-learning), and mobile learning (m-learning). D-learning is defined as learning that contains a geographic and temporal separation from the instructor. E-learning is a type of d-learning that incorporates "computer and internet technology" (Denny, 2013, p. 765). Finally, he defines m-learning as another stage in the process of d-learning and e-learning and as "the ability to learn everywhere at every time without permanent physical connection to cable networks" (Denny, 2013).

Denny (2013) points out that distance education has existed for over a century in the form of correspondence schools. As time passed and technology developed, e-learning evolved. With e-learning, educators took the concept of distance learning and applied it to the computer and the Internet. In addition, more traditional methods of d-learning continued to be used, including old-fashioned correspondence classes and satellite-based d-learning (Denny, 2013). Denny's (2013) definition of m-learning takes issue with the previous literature's definitions which considered m-learning to be that which is "only wireless or Internet based" (p. 766), thus the addition of learning that may take place anywhere, anytime, without connection to a network or cables. Under this definition, any type of portable electronic device can be used in m-learning, including cell phones, PDA tablets, and portable computers, the commonality of these devices being the ability to communicate wirelessly. Nyíri (2002) proposes a similar

definition of mobile learning that he approaches as involving situation-dependent knowledge. For Nyíri (2002), the knowledge at which m-learning aims, by its nature, transcends various academic disciplines. In his conception,

> "its organizing principles arise from practical tasks; its contents are multisensorial; its elements are linked to each other not just by texts, but also by diagrams, pictures, and maps . . . science today is ready to meet the needs of m-learning" (Nyíri, 2002, p. 5).

Awedh et al. (2015) pointed out that in the United States, the term "distance education" is frequently used in discussions of mobile learning, and online learning is typically described as the medium for distance education. However, distance is not necessarily a criterion of e-learning (Awedh et al., 2015). Indeed, Evans (2008) states that the rise of laptops, tablets, and smartphone devices have acted as a mobile learning catalyst in higher education.

In addition to these in-depth definitions and explanations of m-learning, Kahu (2013) defined mobile learning as the acquisition of knowledge through the use of mobile technology. In a similar manner, Sarrab, Elbasir, and Alnaeli (2016) defined mobile learning as the delivery of education materials using wireless technologies, Internet connectivity and information based products and services. These definitions are broad enough to include all types of mobile technologies, regardless of whether that technology is on a phone, tablet, or some other device.

As research reports underscore, a difficulty with defining technology-assisted, mobile, distance, electronic, and otherwise non-traditional learning exists (Awedh et al., 2015). Relevant reports contain discussions of what constitutes technology-based learning. They highlight the difficulty of defining any one term relating to education and the use of technology, stating that technology-based learning also encompasses related terms, such as online learning, Web-based learning and learning that occurs via the Internet. From this perspective, computer-based learning is restricted to learning using computers. For Awedh et al. (2015), technology-assisted learning is primarily synonymous with e-learning and has largely replaced it in scholarship and industry research and practice.

Research literature also explains that TBL is distinct from “technology-delivered learning," and does not include learning

> "that would be covered by either distance learning or technology-delivered learning. In addition, technology-enhanced learning is described as a methodology in which technology plays a subordinate role and serves to enrich a traditional face-to-face classroom” (Awedh et al., 2015, p. 4).

Given that this study is about the use of smartphones for online study and that students can use smartphones to access content from almost any location, a simple definition is appropriate. Therefore, the working definition of mobile learning that this study adopts is learning as knowledge acquisition that takes place outside of the classroom, uses portable or mobile devices, such as laptops, smartphones and tablets, and is enabled by wireless networks and the Internet, to access education materials (Denny, 2013; Evans, 2008; Kahu, 2013; Sarrab, Elbasir, & Alnaeli, 2016; Woodcock et al., 2012, Zacharia, Lazaridou, & Avraamidou, 2016).

2.5 Information Technology and Mobile Learning

This section reviews m-learning from a deeper perspective looking at the rise and spread of mobile devices and global trends toward high connectivity. Various articles concerning the need for learning institutions and infrastructures to keep up with the pace of technological advances are discussed, and evidence is given that smartphone use is increasing at a tremendous rate. According to Tami (2014, p. 1),

> "online students are able to access course content through the smartphones, and such ability makes electronic learning easy. […] The trend in smartphone use suggests that smartphone technology is a field deserving a wide range of studies so that institutions can plan for the future and take advantage of any positive effects while mitigating any possible negative outcomes of M-learning."

The increased use of smartphones by online students, thus, narrows the distance between mobile learning and e-learning.

Rosenberg (2001) predicted that the world of e-learning, which has been around for forty years in one form or another, would continue to grow and change as technology evolves.

As a result, he suggested, “strategy development and implementation are never really finished”; they must be changed and adapted as the technology itself changes and adapts (Rosenberg, 2001, xviii). This is particularly important as the way students use mobile devices continues to change and grow (Rajasingham, 2011). UNESCO (2014) reported that over six billion people now have access to mobile learning technologies. The technology is so widespread that it is changing people’s way of life and way of learning. It extends into all facets of learning, from teacher education, lifetime learning, e-learning, educational management and the provision of open educational resources (OERs) (UNESCO (2014).

Research and industry reports suggest that "restricting student access to network services while on school grounds" is "indefensible" because the technologies available today give students ample opportunity to learn around the clock (FCC.gov, 2010, p. 257). The FCC's research suggested that students who do not enjoy the benefits of mobile technologies outside of normal educational hours may experience a learning disadvantage (FCC.gov, 2010). The FCC considered the community use of educational network services to be so critical that it has recommended the public be allowed to use school network services that have available bandwidth. Classes such as adult on-the-job training, night programs, and other services are likely to involve potential benefits and lead to positive changes in the community (FCC.gov, 2010).

According to the FCC, prior to the second decade of the 21st century, all public community colleges should be given high-speed broadband and also the capacity to maintain connectivity (FCC.gov, 2010). Increasing broadband access improves student service; using mobile devices, students can access their learning materials, as well as research materials, anywhere that wireless or Internet access is available (Osman, El-Hussein, & Cronje, 2010).

However, one concern that still raises a question is the nature of smartphones and other technology devices. The ubiquitous nature of smartphones, tablets, and personal computing devices (Cook, Pachler, & Bachmair, 2011), combined with their ready acceptance in colleges and universities as learning tools, should lead to questions about how well these devices function to directly augment teaching and learning (Boyd, 2014).

Youth usage of smartphones is remarkably high, with one-third of the students who have smartphones using them as their primary internet access devise (Duggan & Smith, 2013). Mavletova (2013) found that students who responded to surveys using a mobile phone showed no more difficulty in responding to complex questions than did desktop users, suggesting that traditional college age students have acquired mobile phone navigation skills. Furthermore, Mavletova's (2013) research results cannot be approached as indicators of an insignificant impact of smart mobile devices on learning-related outcomes, such as the completion of online questionnaires. In this study, mobile web interfaces were found to be associated with shorter answer length and lower completion rates than those based on personal computers' browsers, even though no difference was found in the levels of non-substantive or irrelevant responses among randomly selected respondents (Mavletova, 2013). Given that mobile device users tend to be younger, this study also found significant age differences between mobile device and PC user samples (Mavletova, 2013).

Additionally, Peytchev and Hill (2010) discovered in their research conducted among a randomly selected sample of 220 adults in the United States that smartphone users tended to select responses that were initially exposed to their screen display and were less apt to scroll for additional selections. These findings indicate that the unique features of mobile devices, such as screen sizes, and individual device navigation styles, are likely to affect the manner in which individuals consume information and interact with online platforms (Peytchev & Hill, 2010). However, these conclusions may not necessarily apply to younger age cohorts, such as students, that are native users of mobile devices.

According to Tami (2014, p. 1), students in the higher education institutions are significantly more likely to possess and use smartphones as mobile devices of choice rather than tablets. Additionally, their research corroborates Boyd's (2014) ethnographic research based on participant observations and more than 166 semi-structured interviews with teenagers and adults conducted between 2007 and 2010 that undergraduate-age youth used their phone as a connectivity device such as via social media. Boyd (2014) postulates that youth online social engagement mirrors the level of social engagement in person, since social media play an increasing role in the social media of North American teenagers, even though the

importance of particular mobile connectivity platforms, such as Facebook or Instagram, is likely to vary between age cohorts, as mobile application popularity changes.

While these technology-induced changes in student social life are likely to affect the forms its online expressions take, as they can expand their visibility, audiences and accessibility, their impact on formal learning processes, beyond that of distraction, remains under-researched, since social media provide multiple opportunities for informal learning (Boyd, 2014).

However, based on quantitative and qualitative data derived from student feedback obtained through multiple-choice and unstructured student responses, the study by Blackburn and Stroud (2015) discovered that while mobile learning environments can significantly increase student engagements, the use of mobile technologies can also involve challenges while leading to negative student reactions. In other words, though mobile phones can be integrated into in-class learning, as Blackburn and Stroud's (2015) findings also indicate, important preconditions need to be met, such as distributing online system use instructions and providing multiple information channels, before students can make learning-relevant use of their smartphone. Additionally, the utilization of mobile phone in classrooms can make learning processes vulnerable to disruptions via technology failures, which is under-emphasized by Blackburn and Stroud (2015).

It is important, then, to participate in "assessing initial skill levels at induction and finding ways to scaffold learning, building on those foundational skills in order to aid students in reaching higher levels of digital literacy" (Stevenson & Wright, 2015, p. 142). A qualitative study conducted by Stevenson and Wright (2015) based on a pilot project that used mobile devices to teach students the skills of journalism-related storytelling confirmed the results of the previous study, since it demonstrated the pedagogical potential of mobile learning. The key, according to Stevenson and Wright (2015), is that students must be confident with the devices in order to get the most out of them. This has implications for those students in lower economic strata, who may not have had access to smartphones earlier (and who indeed, may not have access to them in university).

Thus, programs that are developed for students must ensure that both students and the instructors who teach online students should be trained on the appropriate ways of initial acquisition and utilization of the devices. Stevenson and Wright (2015) wrote:

> "At an institutional level, there is a need to make smart device technology readily available on short- or long-term loans to students from low disadvantaged backgrounds where they have had no access to personal smart technology. Those with responsibility for the professional development of staff need to understand how to support colleagues in using personal devices without invading the personal spaces represented by their devices" (Stevenson and Wright, 2015, p. 154).

While this approach would be particularly important for students who have lower levels of knowledge on how to use smartphones, Stevenson and Wright (2015) may be over-emphasizing the importance of socio-economic factors as barriers for mobile learning, while under-estimating the wide variability of learning outcomes which can be inherent to mobile learning as a technology-assisted approach to teaching. This was, in fact, one of the findings of the Méndez and Slisko (2013, p. 23) study, as discussed in detail later in this thesis (cf., pp. 55-56).

As the use of mobile technologies has expanded, the way that various universities in the United States approach student learning has changed, particularly in areas that may have problems accessing in-class learning (Wang, Shen, Novak, & Pan, 2009). In recent years, technology and accessibility have developed to the point that it has become practical to carry out research based on the idea of continuous availability of m-learning, as mobile devices have become accessible in learning environments across the globe (Oyelere, Suhonen, & Sutinen, 2016; Rekkedal & Dye, 2007). Now that it is clear that online students are using smartphones to engage in m-learning more and more (Chan, Walker, & Gleaves, 2015), it is becoming increasingly necessary to study how and if these devices are affecting those students, especially in respect to their engagement. The following section discusses student engagement at greater length.

2.6 M-Learning, E-Learning and Student Engagement

This section will explore the use of technology to enhance students' engagement and successful and unsuccessful attempts to use it to do so. Recent research has shown that various technologies such as those that make up Web 2.0, social networks, cloud computing and Student Response Systems (SRS) can be successfully incorporated into education, while contributing to the creation of online learning communities (Chuang, 2016). Yet, further research concerning student engagement, specifically with regard to smartphones, is needed.

Before moving on to further literature, a review of previous attempts to capitalize on the rise of m-learning is necessary, since the advantages of m-learning can be used to enhance student engagement in online studying. According to the results of Keegan's (2005) research project, which explored the creation of classwork for mobile phones, PDAs, and smartphones, students can be expected to like e-learning and m-learning, and memory problems, which were an issue with mobile phones at the time, could be solved with contemporary smartphones.

This is of particular interest for student engagement because Keegan's (2005) study addressed a target group of students who did not attend physical classes, training, or college. However, this study was primarily theoretical and comparative, its conclusions and recommendations do not necessarily have a solid empirical footing. Moreover, Keegan (2005) approached m-learning from the perspective of the universities developing mobile learning materials and programs. However, student-centric insights are missing in Keegan's (2005) study, especially since students with high levels of mobile connectivity but who are disengaged in learning exist.

Similarly, a US project conducted for the Department of Defense (DoD) investigated whether the conversion of classes from e-learning to m-learning formats could enhance student engagement (Haag, 2011). The DoD chose to offer the program *Trafficking in Persons (TIP) General Awareness Training* in a mobile learning format. Both active duty service personnel and civilian students who took the class were interviewed (n=71) and participated in focus groups to let the developers know what they thought (Haag, 2011). The researchers concluded:

> "Based on the results of this study, it is possible that mandatory training could be made more accessible and to feel less forced upon if a mobile alternative was available. Mobile course delivery affords true self-paced opportunities for completion, anytime and anywhere" (Haag, 2011, p. 12).

The DoD project concluded not only that students felt "less forced" when provided with an m-learning option, thereby increasing engagement, but that the m-learning format also influenced learning approaches, "afford[ing] self-paced opportunities for completion, anytime and anywhere," echoing Keegan's (2005) definition of m-learning. These studies, thus, suggest a possible relationship between m-learning and engagement and learning approach, which demands additional empirical investigation.

Likewise, the US National Survey of Student Engagement found that the collaboration among instructor and peers (group work) positively affects student engagement and learning (Ma et al., 2015). Engagement as part of active learning supports group work, including peer instruction. Blackburn and Stroud (2015) asserted that active learning techniques in which students take action rather than merely sit and listen are more effective than merely lecturing. They developed a student response system where instructors could "call on" learners, who then respond by voting with their phones. Blackburn and Stroud (2015) found that this technological implementation increased student participation and engagement.

One of the most difficult facets of mobile instruction appears to be developing the questions to stimulate student engagement. At Stanford University, this problem was solved with an innovative format that provided eight to ten minutes of video lectures interspersed with a software platform that would allow students to network and discuss issues online (Waldrop, 2013).

The issues of online learning, such as low completion rates, appear to be largely mitigated using interactive software platforms such as Socrative™ student response system developed for the purposes of collaborative learning, as Awedh et al. (2015) found in their study. These platforms allow students to use smartphones for real-time feedback and networking, which can be integrated not only in classroom environments but also in online environments. By incorporating the correct software, Awedh et al. (2015) were able to enhance

student engagement. This implies that m-learning could be effective for those students who do not attend classes physically and using their smartphones makes it easier to access online learning (Awedh et al., 2015).

SRS, which are systems allowing immediate in-class interactions and dialogue between students and instructors, represent a promising development in learning technology. These systems can be used via multiple interfaces including smartphones. While in-class SRS are slightly different from the learning management systems that are the focus of this study, a brief review of two projects incorporating students interacting with their SRS via smartphone is warranted as an example of how these devices affect student engagement.

Student engagement, as has been discussed within the context of higher education, is a process of becoming actively involved in learning in which course content and information is considered, discussed and debated, as opposed to passive involvement in which students simply seek to memorize information for the sake of completing a test or some other examination, such as higher levels of student engagement in discussion forums than in other online learning frameworks, which is similar to deep learning (Wang et al., 2009; Osman et al., 2010; Salter & Conneely, 2015). Within the academic literature, researchers have argued that the use of mobile devices can lead to greater student engagement because students tend to become more actively involved in the learning process through online networks, such as a possible positive impact of mobile learning on student involvement (Kim, Mims, & Holmes, 2006; Skiba, 2008; Reychav & Wu, 2015).

For this context, we will specifically focus on the definition provided by Krause and Coates (2008), that student engagement is "the contribution that students make towards their learning, as with their time, commitment and resources" (as cited in Kahn, 2014, p. 1005).

The high level of smartphone use, particularly among higher education students in the United States, makes the smartphone an ideal successor to earlier efforts at developing engagement that tended to use a combination of overhead projectors and 'clickers.' A 'clicker' is a device that "communicates with software running on a PC connected to the overhead projector system" (Dervan, 2014). They allow instructors to pause their lecture and ask for

feedback as well as present questions to and interact with every student instantaneously. But such a technology required institutions to invest in the physical equipment.

In 2014 smartphone ownership averaged 80% or more in most nations at typical university ages; smartphone usage among individuals age 15 to 35 is estimated to be 96% (Dervan, 2014). Today's schools and universities are in the position of needing to provide a high-quality education to increasing numbers of students at a time when the available funding per student may be decreasing (Freelon, Bertran, & Rogers, 2012). Thus, a solution that increases engagement and allows teachers to pay closer attention to students with academic concerns and without investment into further equipment warrants investigation.

The problem of engagement might be easier to overcome by exploiting the students' natural proficiency with their personal devices. The TAM problem described by Davis (1989; 2003) is also overcome with this approach. For this reason, Web 2.0 is a promising development for the field of m-learning. Web 2.0 can be loosely defined as a collection of tools that can be used to create, edit, share, and collaborate online. Using Web 2.0 allows students to take classes through any equipment that can access the Internet. It effectively turns electronic devices into interactive learning devices (Wankel & Blessinger, 2013).

Wankel and Blessinger (2013) suggest that the original Web, or Web 1.0, was centered around content, while Web 2.0 is socially centered. The social-centric paradigm emphasizes applications that are participatory and tools that can be used to socially network, to access social media, and to interact in a number of other ways. These technologies are digital, ubiquitous, low cost, and easily applied in academic settings (Wankel & Blessinger, 2013). According to Wankel and Blessinger (2013), Web 2.0 essentially overlaps with other technologies and integrates with them, creating an experience that can take the student from one educational and social venue to another with a seamless or near seamless experience. Bruner's (1996) concept of scaffolding and Vygotsky's (1978) theory of the Zone of Proximal Development (ZPD) is particularly applicable to Web 2.0:

> "The distances between the actual developmental level as determined by independent problem solving and the amount of potential development as

> achieved through problem-solving under guidance by an older person, or in association with more capable peers" (Vygotsky, 1978, p. 86).

Indeed, the implications of the concept of Web 2.0 and its educational applications are that it expands learning into the social world. Thus, it would allow students who are working or studying alone to collaborate with more capable peers and learn. It becomes possible for the student to expand their Zone of Proximal Development (ZPD) and progress to the next level of learning.

Wankel and Blessinger (2013) referred to Web 2.0 technologies as being transformative of the student learning process. The widespread use of smartphones, tablets, and other mobile devices and their applications in the current education program allow the instructor the opportunity to observe both the work and interactions of students whom they have never met in person. By observing the student's work, the instructor can tailor activities or assignments to student needs in general, or to one student's needs in particular (Wankel & Blessinger, 2013). Essentially, engaging with Web 2.0 using smartphones has the potential to increase collaboration and dialogue between students and their instructors and more skilled peers. This could easily lead to high student engagement and more effective learning by expanding their ZPD.

Instructors can develop and distribute quizzes almost instantly via SRS, and students can be timed and be assessed immediately (Socrative™.com, 2015). SRS also have a number of applications that students can use for collaborative work. Instructors can poll the class or members of the class groups and allow peers to edit materials directly into the system, which is accessed through the cloud. The level of what Moore (1983) might call dialogue is thus very high and the TAM problem is overcome because the students use their own devices to interface with the SRS.

In their empirical study conducted in a community college in Saudi Arabia and involving 38 architecture students in which multiple-choice quizzes were administered before and after a collaborative learning experience, Awedh et al. (2015) researched the use of smartphones with an SRS (specifically the program Socrative™). They found that it encouraged students not only

in independent academic growth but also in collaborative learning. Collaboration, in turn, improved engagement, and interactivity with the instructor increased overall collaborative teaching (Awedh et al., 2015).

However, the study of Awedh et al. (2015) primarily used descriptive data analysis methods based on a sample that is not necessarily representative of the general student population, which limits the generalizability of their study. Nevertheless, their results showed that students supported the use of Socrative™ and felt that it kept them engaged and interested. They reported that Socrative™ supported collaboration (95% (n=36) agree), allowed information exchange with other students (94% (n=35) agree), provided an opportunity to discuss issues with the instructor (89% (n=32)), allowed information exchange with the instructor (90% (n=33)), improved personal relationships with peers and teacher (85% (n=30)), improved comprehension of concepts studied in class (91% (n=34)), allowed the student to participate in their own learning (85% (n=30)), and allowed the student to feel that they actively collaborated in learning experiences (84% (n=29)).

According to Awedh et al. (2015), the main benefits to the use of Socrative appeared to be that using smartphones is free to the school and can facilitate classroom learning. Use of the system motivates students and engages them, as well as allowing the development of communication and collaborative skills. Awedh et al. (2015) did conclude that any further testing should include the use of a control group. As a major drawback of the study, this flaw prevents any definite conclusions that the use of mobile phones added to the classroom experience.

Méndez and Slisko (2013) also conducted research on the use of Socrative™ in a blended learning class of 36 individuals intending to be physics teachers in Mexico, in which mobile learning was combined with in-class group discussions based on student responses. Méndez and Slisko (2013) used a 7-item questionnaire with 5-point Likert scales, to collect primary data on the basis of which they examined their research questions. Méndez and Slisko (2013) reported that one of the difficulties the university had been encountering was that students would not reveal they had doubts about the information, nor would they respond to

questions. In seeking a solution, the researchers considered the technology that was available to stimulate natural learning. They concluded that with the ubiquitous nature of smartphones and laptops, a solution that used this technology without the need for additional equipment would be ideal.

Of the 36 students, 70% (n=25) felt that Socrative™ helped them become more involved and 94% (n=34) felt it stimulated collaboration (Méndez & Slisko, 2013). Just under half of the students reported that the best part of the Socrative™ process was collaboration. A minor limitation of the usefulness of the technology was revealed when they found that 10% (n=4) felt that more effort should be made to ensure everyone had smartphones.

Nevertheless, Méndez and Slisko's (2013) study has not contrasted its findings with a comparable group of students in a class where m-learning was not employed, which further limits the generalizability of their conclusions. Since its questionnaire was relatively short, Méndez and Slisko's (2013) research also did not examine either antecedent factors or dependent variables related to m-learning. This echoes the warning expressed by Blackburn and Stroud (2015) that institutions wishing to implement smartphone use and m-learning on a larger, formal scale need to ensure that every student has access to a smartphone, as well as access to training that will teach them how to use it most effectively.

Another drawback in Méndez and Slisko's (2013) study was that the Internet was intermittent and not consistent at this location, underscoring the necessity of institutions investing in the requisite infrastructure and accommodating students who may not have access to smartphones if they are interested in expanding their m-learning programs.

While Web 2.0 and SRS do not specifically involve the use of smartphones interacting with an LMS, they indicated that incorporating smartphones into education had the potential to overcome the TAM problem and encourage higher student engagement, which warrants further study on integrating smartphones into education.

Handelsman et al. (2005) developed a 27-item questionnaire for estimating student engagement in classroom environments: The Student Course Engagement Questionnaire (SCEQ) using 5-point measurement scales. Based on their exploratory factor analysis of the

primary survey data collected from 266 undergraduate students aged from 18 to 56 at the University of Colorado at Denver, Handelsman et al.'s (2005) survey does not consider engagement as one characteristic or just as behaviors but in light of its different components: skills engagement (what students "do"); emotional engagement (how connected they feel to the course/content, which is particularly essential in online courses; how pertinent they feel it is); participation/collaboration engagement (connecting with others, getting a charge out of the substance/course); and performance engagement (students' yearning/objective to prevail in the course).

Whereas Handelsman et al.'s (2005) study has validated the SCEQ, given that it has found four relatively independent factors corresponding to the skills-related, participatory, emotional and performance-related aspects of engagement with high correlations between skills and emotional engagement and low correlations between other factors, this measurement scale is yet to be thoroughly validated for mobile learning environments. Although, Handelsman et al.'s (2005) research can assist in hypothesis development in studies aimed at exploring interrelations between student engagement and various characteristics of m-learning environments, such as student and instructor practices.

2.7 Transactional Distance Theory in M-Learning

The use of smartphones in distance education can be examined using transactional distance theory, which proposes that distance education involves both a physical and a psychological separation (a transactional distance) between the instructor and the student (Fuegen, 2012). The amount of dialogue between teachers and students as well as among peers influences the perception of transactional distance with an increase in dialogue reducing the perception of transactional distance. The theory also relies on the construct of student autonomy in which the learner selects the time that is convenient for accessing instructional materials or for interacting with instructors and students (Reyes, 2013). The instructor can control the degree of student autonomy by establishing deadlines and content requirements.

As a result, the instruction can influence the amount and frequency of student dialogue (Reyes, 2013).

According to Dron and Anderson (2014), transactional distance is the recognizable distance between a student and educator in an education setting. The theory proposes that transactional distance can have a similar effect on students to physical distance; hence it is likely to be related to m-learning. Dron and Anderson (2014) also posit that transactional distance can allow interactions between students and instructors to occur on a variety of spatial and temporal scales. Online students are capable of having a dialogue with the instructor, which creates an online class structure despite the distance between the learner and the educator.

As the originator of the theory of transactional distance, Moore (1993) proposes three variables that are directly or inversely proportional to transactional distance: dialogue, structure, and student autonomy. According to Moore (1993), the theory of transactional distance originally stated that "distance education is not simply a geographic separation of learners and teachers, but, more importantly, is a pedagogical concept" (p. 22). Moore's original work on distance education may have first begun with his dissertation in 1977, which discussed theories of learning related to independent study in a distance environment, particularly as it related to learner autonomy and distance (Moore, 1977).

In his dissertation research carried out between 1974 and 1976 among students engaged in independent study programs in Canada and the United States, Moore (1977) found that students enrolled in independent learning frameworks at a distance were more independent than regular students, but students in local independent study programs were not. Further, fewer distance students preferred non-autonomous learning than those in locally organized independent study programs. In this regard, Moore's (1977) empirical findings indicate significant interrelations between the degree of learning independence, autonomy and distance, on the one hand, and the cognitive style, psychological, and learning-related attitudes, such as satisfaction and positive attitudes, to distance learning.

However, these outcomes do not necessarily indicate causal links between these variables, since students engaged in either distance or local independent study programs may be predisposed to enroll into them and experience their learning experiences positively, due to the effect of other social or psychological factors.

In a later study, he also found that it was possible to predict success in distance study by measuring a learner's field independence, field independent learners being defined as those who were task oriented and less affected by social stimuli than others (Moore, 1993). Moore's (1993) argument was that the further the distance from the school the student was, the more successful independent cognitive styles would be. The corollary was that the closer the student to the school, the less independent cognitive styles were valuable (Moore, 1993).

Moore's (1983) original work highlighted five general areas that he considered desirable for future research. The first suggestion was to determine what system would be the most efficient for producing responsive distance programs. The second recommendation was to determine how to get individuals and teams to articulate what they needed in terms of distance learning. One of the biggest issues he cited was the need to learn how to teach students to be able to study more independently. He questioned if universities should provide distance education in fields such as parenting classes, and how to increase the dialogue in distance classes that did not have much interchange between instructors and students (Moore, 1993).

Finally, he questioned whether there was truly a relationship between autonomy and distance, and if so, which students would benefit from a less structured program (Moore, 1993). One of his main points was that adults engaged in self-directed study programs can expect to be served by professionally developed learning resources, which he believed would be a significant move toward establishing a true learning society (Moore, 1993). From this original interest in independent study, Moore (1993) developed the Transactional Distance Theory.

As the transactional distance theory was developed and honed (Fuegen, 2012), the importance of Moore's three variables was established. The three variables of dialogue, structure, and learning autonomy interacted to increase or decrease transactional distance

(Shearer, 2010). Moore originally defined dialogue as the extent to which learners and educators were able to interact and respond to each other (Moore, 1993). Further, the "medium of communications" was a critical part of what he considered to be environmental factors that would impact the dialogue between the instructor(s) and student(s).

As a factor affecting learing, structure, was defined as "a measure of the educational program's responsiveness to the learner's individual needs" (Moore, 1980, p. 21). An educational program's responsiveness should be supported by objectives, implementation of the educational objectives, and the way that a teaching program was evaluated. Another dimension of Transactional Distance Theory is autonomy. Autonomy is defined as the extent to which the learner rather than the teacher guides the knowledge acquisition process. The degree to which the learner guides the learning can range from not at all to almost entirely, and Moore (1980) asserts that the learner may even determine the learning goals, procedures and resources, which correspondingly demands the adjustment of the learning evaluation decisions. As the structure and dialogue decrease, learners who are ready for independence will have more autonomy. Instructors assist with this transition by responding to learners based on an assessment of their readiness for autonomy (Andrade, 2016).

The decisions are not made unilaterally but rather are made through dialogue and structure that has been significant enough to give the learner and the instructor a good sense of what the other has to offer for the independent learning process. The transactional distance between the student and the instructor starts out as small as possible, with low autonomy, high structure, and plenty of dialogue. Gradually, the structure and dialogue decrease as the student becomes more autonomous, and the transactional distance between student and instructor widens (Andrade, 2016).

The use of smartphones in distance education can be examined using transactional distance theory. The amount of dialogue between teachers and students as well as among peers influences student engagement to mobile learning. The "anytime, anywhere" aspect of m-learning has the potential to greatly increase dialogue. The instructor can also implement high or low structure by establishing deadlines and content requirements. Both capabilities

have the power to reduce transactional distance substantially. However, smartphones may also have the ability to strongly enhance student autonomy, as the learner can select the time that is convenient for accessing instructional materials or for interacting with instructors and students (Reyes, 2013).

Reyes (2013) pointed out potential pitfalls of transactional distance theory. The first pitfall is that as the theory developed from its beginnings with Moore and from the 1970s into the 1990s it had not been well defined as far as its terms are concerned. As Reyes (2013) quotes Garrison (2000, p. 9), "the exact nature of the interrelationships among structure, dialog, and autonomy is not clear. There is confusion around whether structure and dialog are variables, clusters or dimensions" (in Reyes, 2013, p. 46). Further research and explanation by Moore (1993) in recent decades have attempted to clarify these terms and relationships, and these clarifications are reflected in the above analysis (Reyes, 2013).

In the summary of the study by Chen and Willits (2007) that Reyes (2013) proposes, a criticism of transactional distance theory has been expressed. While conceding that a relationship between dialogue, structure, and autonomy as aspects of distance learning exists, Reyes (2013) also stressed that these studies have failed to substantiate the effect of learner autonomy on transactional distance. As it relates to this study, the interrelationships between structure, dialogue, and autonomy therefore demand further empirical research.

2.8 M-Learning Requires an Applied Pedagogy

As instructional devices, mobile phones and tablets have been utilized in classroom situations to facilitate student learning to a significant degree, according to past empirical studies, such as that of Ktoridou and Eteokleous (2005). These studies have derived the pedagogical potential of various handheld and mobile devices, such as digital assistants and Internet-enabled tablets, based on their technological characteristics and capacities, e.g., in terms of curriculum development, collaborative learning, and possible learner benefits (Ktoridou & Eteokleous, 2005).

Mobile devices can bolster correspondence between learners and educators, as well as influence document sharing, communication and data exchanges. Additionally, mobile apparatuses can be used as an instructional device. For instance, students can execute their learning tasks on mobile devices. Educators can give students e-books, content, and other learning materials (Ozdamli, 2012). Instructors in the sciences have included these devices in the structure of conventional classrooms to show lessons, convey course materials, provide a framework for learning, and to evaluate student information, aptitudes, and learning (Ozdamli, 2012; Chang, Chen, & Hsu, 2011; Thornton & Houser, 2005; Facer et al., 2003).

More specifically, in their study among 333 female Japanese undergraduate-level university students, Thornton and Houser (2005) conducted a quantitative, survey-based inquiry into the prospects of m-learning, since all research participants were found to own mobile phones. Thornton and Houser (2005) found that the majority (66%; n=220) of these research participants used their smartphones for sending emails about class materials and 44% (n=147) for studying purposes, while exchanging approximately 200 e-mail messages over their mobile phones on a weekly basis, as compared to about only 2 e-mails on their PCs per week.

Similarly, in the framework of the experiment they also conducted, after sending short vocabulary lessons to the smartphones of 44 Japanese speakers studying English as a Foreign Language (EFL), Thornton and Houser (2005) discovered that mobile phones prompt significantly more learning activities as contrasted to peers who got similar lessons by means of customary or online teaching environments. Thornton and Houser (2005) also found that 71% (n=31) of those students who took part in this pedagogical intervention prefer m-learning to PC-based learning, especially since diverse pedagogical materials can be integrated on mobile learning platforms.

Given that in recent decades mobile phones have significantly improved their capabilities, it can be expected that these studies can be extrapolated to other academic subjects or student groups. Additionally, Thornton and Houser's (2005) findings could be unique to Japan, where high levels of mobile technology readiness have existed in recent decades. Additionally, EFL instruction may be significantly different from other academic

subjects in terms of its amenability to mobile learning, student readiness to engage in studying complex academic subjects primarily on their smartphones and the overall effectiveness of m-learning, such as due to distractions they also offer.

Facer et al. (2003) arrived at similar conclusions in their study where they used m-learning methods to educate primary school children about animal behavior and survival as part of their efforts at creating engaging learning settings. Though they found that m-learning technologies helped students enhance spatial thinking and their understanding of geometry through a mobile game, while offering third graders general science lessons, Facer et al. (2003) also indicated that mobile learning is likely to be pedagogically challenging, due to the demands it places on learning organization, learning materials and course design.

In other words, no consensus about the effectiveness of m-learning among different student groups, such as university students, exists, also because many past studies are theoretical, rather than empirical (Facer et al., 2003; Thornton & Houser, 2005; Looi et al., 2010; Chang, Chen, and Hsu, 2011). Nevertheless, tentative indications that mobile devices and their abilities are appropriate for science learning can be found (Friedel, Bos, & Lee, 2013).

Of critical importance is the fact that the instructive utilization of handheld computerized devices is likely to support constructivist science classrooms by prompting higher interest levels – especially in issue-based and community-oriented situations (Lin et al., 2011; Markett et al., 2006; White, 2006; Davis, 2003). These higher interest levels are encouraged through mobile devices in various ways and continue to draw research interest, especially since m-learning is associated not only with online learning opportunities, but also with challenges, such as possibly low motivation levels, e.g., among adult learners, that the introduction of m-learning needs to address via accounting for the affective and social factors that are likely to affect m-learning adoption (Hashim, Tan, & Rashid, 2015).

First, mobile devices can be expected to increase interest by enabling bashful students to engage in learning processes while remaining secretly responsible for their support inside a classroom (Davis, 2003). Second, they make synchronous parallel cooperation conceivable inside an entire class (White, 2006; Davis, 2003). The capacity for bashful students to remain

openly unknown while secretly responsible inside the classroom expands value in support and enables all students to take a similar interest in an entire class setting (Davis, 2003). At long last, the small size and transportability of mobiles empower students to connect with each other and their educators and to access data and transfer information from basically any setting (Sánchez & Olivares, 2011; Looi et al., 2010). This anyplace/at whatever time aspect accommodates innovative learning methods from inside and outside of class settings (Looi et al., 2010).

The emergence of versatile mobile devices amenable for learning purposes warrants a similarly advanced pedagogy—particularly one supporting mobile devices' utilization throughout multiple academic subjects, such as that of constructivist learning (Muyinda, 2007).

Moreover, in previous studies, the components of an m-learning pedagogy have been proposed. Muyinda (2007), referring to Sharples, Taylor, and Vavoula (2005), recognized as preliminary requirements for the detailing of an m-learning methodology that one must recognize what is remarkable about m-learning contrasted with different sorts of learning; decide and grasp the measure of learning that happens outside of the classroom under the sponsorship of m-learning; consider contemporary teaching methods, for example, learner-centeredness, information-centeredness, evaluation-centeredness, and group-centeredness; and account for the omnipresence of individual and shared innovation (Muyinda, 2007; Sharples, et al., 2005).

Thus, via semi-structured and closed interviews using the survey instruments of closed questionnaire and face-to-face discussions with 3 distance education and computer technology experts, Koole (2005) was able to develop a theoretical model on the basis of his in-depth inquiry into the adequacy of mobile devices for distance and mobile learning in view of constructivist ideas that learning happens through cognizance and social association (Koole, 2005). However, due to the small size of Koole's (2005) research sample which cannot be considered representative of distance learning practitioners and the rapid pace of technological development, the conclusions of this study are both non-generalizable and out of date with the

present state-of-the-art mobile devices to which average students can be expected to have access, in terms of their capabilities and characteristics.

As Crescente and Lee (2011) highlight in their review of extant scholarly literature, a gadget's ease of use relates to the usefulness of the mobile devices, learner perspectives allude to the psychological attitudes and earlier information of learners, and social angles accentuate singular responses of learners in the course of social interactions. Thus, as Crescente and Lee (2011) and Koole (2005) conclude, mobile learning as an approach to learning can, nevertheless, be expected to enrich learning experiences, personalize learning processes and create location-independent communities of dynamic learning.

Ozdamli (2012) distinguished four requirements of an instructive structure for mobile learning: the reconciliation of apparatuses, instructive methodologies, appraisal strategies, and educator preparation. Theory-based methodologies (for example, constructivism, mixed learning, shared learning, and dynamic learning) have been recommended as the foundation of developing m-learning pedagogical approaches (Ozdamli, 2012).

Mobile learning projects can utilize the inherent components of mobile devices, for instance, sound recording, content informing, GPS, cameras, and commonly accessible programming packages as means for the acquisition of learning-relevant capacities. This is illustrated by Mathews' (2010) project aimed at imparting to 12 high-school students design literacies as part of researching their city while using game-like mobile applications. In the framework of his project, Mathews (2010) acquainted students that took part in this pilot study with mobile application design and media content distribution as part of creating an interactive learning environment where multiple literacies have been acquired. This mobile augmented reality environment involved students acting as advisors employed by the city to find challenging places and issues inside the downtown territory of the urban area. As they strolled around town in sets, searching for, watching and dissecting challenged places, the students utilized mobile devices to direct meetings, take photographs, get to up-to-the-minute data, and record notes (Mathews, 2010).

There is a gap in scholarly literature between studies concentrating on the capability of mobile devices and the advantages they provide for m-learning and those proposing pedagogical recommendations for educators who could consolidate it in their practice. Since m-learning could enable discussions between a teacher or instructor with students, overseers, and guardians, changes to basic instructional approaches of the school are likely to be required.

Additionally, as the preliminary phenomenological qualitative study of Garthwait and Weller (2005) based on empirical data collected from two teachers engaged in laptop-enabled instruction at a representative middle school in the United States indicates, an adequate utilization of mobile learning devices in evaluation-focused learning conditions is likely to depend on the degree to which instructors can resolve technical technological issues and implement policies that promote the application of computing and mobile technologies in classrooms.

The introduction of mobile devices into learning environments can, thus, demand pedagogical approaches that would consider how smartphones, information systems, advanced computing capabilities and mobile applications can facilitate learning (Fleming, 2012; Freeman, 2012). Although the instruction applications continue to develop, it is clear that increasingly powerful mobile devices and their capacity to facilitate place-independent learning via ubiquitous computing have the ability to change learning processes in both school and university settings.

2.9 LMS Access via Mobile Device

As one of the major roadblocks to implementing and using m-learning appears to be how students' smartphones interact with online course material, it is important to consider learning management systems and how their design and interactivity with smartphones is related to success or failure. This section discusses the factors that contribute to a successful LMS before moving on to considering the relationship between LMS and smartphone use.

LMS systems can integrate a variety of teaching tools and can include interfaces for online lectures and for web-based systems of delivering education, since LMS systems allow the student to use a browser to access information programmed into the LMS (Coates, James, & Baldwin, 2005).

In their study conducted based on a sample of 379 Midwestern university instructors using either Blackboard or WebCT for both distance learning and web-assisted courses in the United States, Wang, Doll, Deng, Park, and Yang (2013) found that high levels of interface, interaction and content configurability in LMS are associated with the higher levels of ability of course developers to implement effective teaching principles. In other words, once users were able to use the system to receive information, they graduated into using it for communication, which facilitated their ability to derive benefit from these LMS. If the users perceived the LMS to be easy to use, they were far more likely to accept it (Wang et al., 2013).

Knowing that IT support was readily available and easily accessible was important to instructors. Furthermore, Wang et al. (2013) also indicated that the configurability of LMS is likely to be positively associated with quality of course content and teaching practices in distance learning environments. However, given the constant development of new LMS environments, this relationship between LMS configurability and the effectiveness, quality and benefits of distance learning is likely to be limited. Moreover, since the empirical study of Wang et al. (2013) had a response rate of 12% only its findings can be non-representative of the general population of university-level instructors and course developers in the United States.

The Technology Acceptance Mode (TAM) established by Davis (1989) is based on the assumption that behavior involves both the perception of usefulness related to performance and ease of use (i.e., it will not be too difficult to learn, nor will it be too difficult to use). Although other models, such as ones based on the Theory of Reasoned Action proposed by Fishbein and Ajzen (2011), have been suggested in order to explain adaptation to and acceptance of technology, TAM has been widely adopted (De Smet, Bourgonjon, De Wever, Schellens, & Valcke, 2012). However, TAM focuses upon *intent to use* in the model, and Van Raaij and Schepers (2008) suggest that the use of LMS is now so ubiquitous that intent to use is

becoming archaic and may need to be addressed as *the individual's personal attitude toward usage*. Wankel and Blessinger (2013) also point out that Web 2.0 technologies, such as Internet-based social networks, can be used to support learning.

Koller, Harvey, and Magnotta (2006) explained that research in the late 1990s suggested that the first hurdle in LMS utilization was that users needed to have a basic understanding of technology. This study concentrates on basic understanding as fundamental to the acceptance of training and online learning, whether in government, industry, or educational applications from K-12 to post-graduate work (Koller et. al, 2006). This concern is particularly of interest given not only the ubiquitous nature of digital technology today but the ubiquitous nature of the *usage* of that technology.

Smartphones are now the primary type of basic mobile computing device used by students in higher education worldwide (Yu, 2012). Students use smartphones when away from computer terminals to remain connected with a social and educational environment. Smartphones have the capability to interface with an LMS while allowing the student to download numerous apps that can be beneficial in the learning process (Vazques-Cano, 2014).

Apps and the platform interface can also influence the perceived usefulness among students of the smartphone for accessing the LMS. The willingness of individuals to use an available technology depends on their proficiency with the technology and their perception of the usefulness of the technology (Chang, Yan, & Tseng, 2012). Because smartphones are becoming ubiquitous, the general assumption is that online education students have the necessary skills to use them. Consequently, the decision to use a smartphone for various online learning activities depends on the perception that the smartphone will be useful for performing learning tasks. If the institution does not have sufficient apps to allow full access to the LMS, the student is less likely to use the smartphone because the student will not find substantial utility for the device in the online learning process (Shin, Shin, Choo, & Beam, 2011).

This makes it clear that the TAM problem for m-learning has been eliminated from the students' side of the equation. They own their smartphones. They know how to use them and use them proficiently. Then, if the LMS is easy to learn and use, the hurdle described by Koller

et al., (2006) is cleared, allowing students and instructors to easily engage with the LMS via smartphone.

2.10 Student Approaches to Learning

A widely published conceptualization of the diverse ways students approach academic tasks is the three-way categorization described earlier—deep, surface, and strategic learning (Marton & Säljö, 1997; Tait et al., 1998; Trigwell & Prosser, 1991). When students engage in surface learning, they are simply regurgitating information provided to them without engaging in any further thought or analysis of the information. Furthermore, students engaged in surface learning do not question the information they receive or attempt to connect the information to larger theories, ideas, or concepts. Sometimes, students will simply try to learn so that they can repeat the key points, or memorize the information that they expect to have on a test. Students engage in rote learning and concentrate on details rather than on larger-scale analysis.

Students employing surface learning often are just doing enough to 'pass' rather than experience a true learning synthesis and connecting prior learnt elements together. These students determine the minimum requirements and address them. When instructors "teach to the test," they may be encouraging surface learning approaches among students. In contrast, deep learning occurs when students question the information they receive and attempt to connect and synthesize the information to larger ideas and concepts (Biggs, 1987; Bloom, 1956).

Students who develop deep learning habits learn to interact with the information they are learning; they seek to understand not only what is being taught but also the implications of what is being taught, in terms of future development. They take the new ideas they have learned, and they compare them to what they learned in the past as well as to their day-to-day experiences. They take a broad view of the information rather than a narrower view (Biggs, 1987; Bloom, 1956).

The third type of learning, strategic learning, is generally defined as being able to move between deep and surface learning, depending on the context, which is likely to be relevant for m-learning that facilitates location-independent learning and may affect the learning style of mobile learners. Students who use strategic learning generally set out to achieve good grades. According to Mackay and Burt (2014), students who use strategic learning tend to be organized workers, have a set time for studying, use study guides and learn to understand the instructor's marking schemes. In addition, Schmeck (2013) adds that students who use a strategic learning approach are more determined to score high in whatever they do. The students are capable of pacing themselves and examining what they need to do to achieve what they want.

However, as Mackay and Burt (2014) argue, learners need to learn to balance their learning practices so that they do not find themselves either concentrating on the larger view of the topic while ignoring the important small facts or concentrating on the smaller facts without sufficient regard to the overall learning activity. Hyperopia is the ability to grasp information that requires a great deal of foresight, while myopia concentrates on a more shortsighted approach. Balance is achieved when experiential learning is not neglected. If the student can put their learning into action, they have developed knowledge and are unlikely to be either too nearsighted or farsighted in terms of analysis (Mackay & Burt, 2014).

In her quantitative study based on a survey of managing directors from 206 Finnish companies in the software sector and expert evaluations conducted in 2009, Sirén (2012) conceives of strategic learning as a multidimensional construct that comprises strategic knowledge creation, interpretation, distribution and implementation as part of organizational learning (Thomas, Sussman, & Henderson, 2001). In this research, strategic learning is approached as a capability of individuals and teams to continuously integrate knowledge and experience into strategies for coping with changing environments (Beer, Voelpel, Leibold, & Tekie, 2005), which sets Sirén's (2012) approach to this concept apart from other studies. Given that theoretical literature on strategic learning, its mechanisms and its processes continues to be fragmented theoretically and empirically, Sirén's (2012) study does not mention the framework of Marton & Säljö, 1997. Sirén (2012) also states that in the strategic learning mode the student is able to determine the best way to study to acquire knowledge. Once the student

understands the information, he or she interprets it and shares it with others. The information can also be analyzed from the standpoint of the student or the standpoint of the teacher who must generally provide a grade and evaluate whether learning and knowledge acquisition has occurred. Finally, he or she takes steps to use the knowledge that they have gained during the strategic learning process. Sirén's (2012) perspective builds on the concept that people can process information in a manner similar to computers, by taking in data, processing it, considering the significance, and taking steps to act on what has been learned. However, Sirén's (2012) study does not account for the possible impact of learning context, such as m-learning, on the prevalence of strategic learning.

The integrated learning process occurs at more than one level. This is a particularly important concept when one speaks of social learning, or learning in a group (whether online or in person). The individual works with the group and potentially with a larger organization to make sense of knowledge being gathered. When the individual is able to make sense of the information that they have studied and interpreted, then internal knowledge is synthesized. At this point, integrated learning occurs. Sirén (2012) concludes that, "strategic learning has a socially constructed and collective nature, comprising different knowledge processes at various levels of an organization" (p. 502).

Sirén also emphasizes that newly created strategic knowledge remains the domain of the student and it is personal knowledge that has very little impact on the school or other students unless the student speaks of the finding to others and ensures it is "amplified through social interactions" (Sirén, 2012, p. 503). In other words, due to the social media uses of smartphones, they may be conducive to strategic learning, of the corresponding m-learning platforms by integrating social interactions into the design of their online education environments (Sirén, 2012).

As transactional distance theory providing a framework for understanding student engagement and learning approaches suggests (Dron & Anderson, 2014), student engagement and active learning strategies may need to incorporate surface, deep, and strategic learning. If m-learning course designs and learning management systems can be used to manipulate

perceptions of transactional distance, it may be possible to motivate higher student engagement and active learning approaches (Dron & Anderson, 2014).

Thus, if smartphone use has a particular effect on strategic learning, it may be an effective way of increasing collaboration and what Moore might call dialogue between students. Additionally, it may also be a method of expanding the Zone of Proximal Development (ZPD) (Vygotsky, 1978), a theoretical concept discussed in later chapters, but which essentially assumes that more learning occurs when more skilled student peers share information with less skilled ones.

2.11 Digital Technology's Impact on Learning Approaches

According to Gikas and Grant (2013), students are the driving force behind the use of mobile learning devices. Based on its study in which 50,274 students from 161 institutions in 11 countries and 43 American states took part, the Educause Center for Applied Research (ECAR) survey conducted in 2015 established that 92% (n=46,252) of university-level students have at least two Internet-enabled mobile devices (Dahlstrom, Brooks, Grajek, & Reeves, 2015). Dahlstrom et al.'s (2015, p. 21) report also indicated that mobile devices are perceived as both sources of distraction and critical for academic success. According to this survey, mobile devices are perceived as a potential source of distraction for respondents (41%; n=20,612), their peers (49%; n=24,634) and their instructors (54%; n=27,148).

Yet over 75% (n=37,706) of all respondents have consistently conceived of laptops as important for their academic success between 2012 and 2015, whereas the importance of smartphone for academic success has risen from over 30% (n=15,082) in 2012 to approximately 40% (n=20,110) in 2015 and tablets have been perceived as critical for academic performance by between 40% (n=20,110) and 50% (n=25,137) of students in this period (Dahlstrom et al., 2015, pp. 21-22).

However, this study also indicates that 60% (n=30,164) or less of the students who were surveyed have found the LMS, course registration, information access, library resources and

other services as good or excellent when accessed from their mobile devices (Dahlstrom et al., 2015, p. 23). Dahlstrom et al. (2015, p. 23) also found mobile devices to be good or excellent for accessing course content and checking grades among between 60% (n=30,164) and 70% (n=35,192) of respondents, while over 70% (n=35,192) of students indicated that these services are either very or extremely important (Dahlstrom et al., 2015, p. 23). These students reported that they used the devices for activities related to academic topics.

As previously discussed, many studies have shown that having a mobile device allows students to access their courses and supporting materials easily. Students can also interact with their instructors, with other students, and even online tutors by using their mobile devices (Gikas & Grant, 2013).

Although, the reasons for the mixed picture that Dahlstrom et al. (2015, p. 21) painted are likely to lie in a relatively low share (17%; n=2,257) of instructors (n=13,276) sampled from 12 countries that make the integration of mobile devices into their course design a priority. Furthermore, whereas only 32% (n=4,248) of instructors have been found to incorporate m-learning into their assignments, 49% (n=6,505) of instructors have been found to ban smartphones and between 16% (n=2,124) and 19% (n=2,522) laptops and tablets respectively from in-class use (Dahlstrom et al., 2015, p. 21).

Therefore, qualitative research methods utilized to study the use of mobile devices in educational settings, e.g., in the research of Gikas and Grant (2013) based on focus group interviews with three instructors and nine students from three United States universities, need to be complemented with quantitative research methodologies and larger sample sizes than is usually the case in qualitative studies, in order to explore the interrelations between the advantages and disadvantages of mobile devices for learning purposes in greater depth than a single research methodology allows.

When examining the elements that influence individuals' behavioral aim to use smartphones for learning, Wang et al. (2009) discovered several determinants—execution hope, exertion hope, social impact, and self-administration of learning—that influence smartphone use. To arrive at their conclusions, Wang et al. (2009) used the methodologies of

case study, online surveys and content analysis, as part of their research on m-learning in blended and distance learning classes for English instruction at Shanghai Jiaotong University, China.

While Wang et al. (2009) sent their survey to 1,000 online and campus-based students enrolled in this class, only 585 learners responded to the online survey, which amounts to a response rate of 58.5%. According to Fraenkel and Wallen (2005, p. 393), this response rate can be considered acceptable, since data collection methods that do not involve direct interaction, such as interviews, usually have low response rates.

Among the findings of Wang et al.'s (2009) study are that execution anticipation, which alludes to students' apparent advantage of learning with mobile technology for themselves, was the most significant determinant of behavioral aim to utilize smartphones for learning (Wang et al., 2009).

Exertion anticipation implies the level of effortlessness utilizing smartphones for learning as seen by the consumer. Social impact alludes to the degree to which an individual perceives trust from other individuals to embrace learning with mobile technology (Wang et al., 2009). Fun-loving nature alludes to the amount of energy one can experience while utilizing mobile smartphone for learning. Thus, according to Wang et al. (2009), the self-administration of learning, such as through innovative m-learning platforms, can be expected to increase according to the degree to which individual learners interact with their pedagogical environments, exhibit emotional, social and cognitive engagement and are exposed to various learning-related materials in their context, which can lead to self-directed learning.

However, it is important to account for the limitations of Wang et al.'s (2009) study, since successful m-learning systems are likely to be highly dependent on continuous steering and encouragement from the side of course instructors, to sustain high or sufficient levels of student engagement in m-learning environments. Additionally, Wang et al.'s (2009) research placed a significant emphasis on the logistic and technological aspects of m-learning. Wang et al.'s (2009) study is also based on a sample of Chinese students, which can limit the generalizability of their findings to other populations. Furthermore, pedagogical design quality

may be a factor likely to significantly affect student engagement levels beyond the nature of online interactions and assignments in which students and instructors participate.

2.12 Gaps in Literature

The literature review examined previous research related to mobile learning and the use of mobile technologies such as smartphones in online education. This literature review presented information concerning the basic electronic technology used for teaching and learning in a digital environment. The literature showed that there are technical issues that must be addressed, in order to continue to improve LMS accessibility. Additionally, based on this review of previous studies (Reyes, 2013), the use of smartphones in online education may have the potential to substantially reduce transactional distance because students can implement learning transactions regardless of their location. However, this statement demands empirical substantiation, since previous research does not shed sufficient light on this aspect of smartphone use. In this literature review, thus, there were several gaps identified.

More specifically, this literature review indicates that the relations between mobile course structure, the degree to which dialogue between learners and their peers and instructors is present, and the extent of learner autonomy in m-learning settings demand additional empirical inquiry, due to the lack of theoretical and empirical consensus in this regard (Reyes, 2013). Likewise, in previous studies divergent empirical findings and theoretical arguments concerning the effectiveness of m-learning exist, especially since mobile learning can be more suited for some student groups than for others (Chang, Chen, and Hsu, 2011; Friedel, Bos, & Lee, 2013). Therefore, it is possible to indicate that a gap in scholarly literature exists, which refers to the degree to which mobile devices, such as smartphones, can be integrated into learning practices and bring pedagogical advantages to students and instructors alike.

Based on these gaps in scholarly literature, this study inquired into the manner in which online students use smartphones for learning purposes, the learning approaches they take when accessing LMS, the level of student engagement that mobile learning involves, the

learning tasks that students accomplish when using mobile devices and the reasons for which students prefer to access LMS in mobile learning settings.

CHAPTER 3 METHODOLOGY

3.1 Introduction

The present study uses an exploratory mixed-methods research design to investigate the use of smartphones by students in online education and the subsequent effect of these devices on learning behavior and student engagement.

The purpose of this chapter is to describe and justify the research methods used to carry out this investigation. The chapter begins with a discussion of the research methods that were used, followed by the research philosophy that was the foundation of this study and the research strategy. Then, the time horizon for the study is discussed. Next, the data analysis and coding procedures are presented. The pilot study that was conducted is discussed, along with the transcription and coding methods that were used. Issues of triangulation and validity, as well as ethical considerations with regard to the treatment of human subjects, are also examined.

The research methodology reported in this thesis used a sequential exploratory mixed-methods strategy approach, with the collection of quantitative data through a survey questionnaire preceding the collection of qualitative data with focus groups. The selection of the mixed-method approach was based on the research questions of this study and the nature of the primary data that are expected to provide answers to these questions. The use of mixed research methods has enabled this study to blend the positivist research paradigm associated with quantitative research with the constructivist research paradigm associated with qualitative research. Thus, in this study pragmatic considerations guided the selection of research methods. The mixed-method research approach also supported triangulation of data from both quantitative and qualitative sources. The qualitative phase of the study was intended to provide an in-depth analysis of the data obtained in the quantitative phase of the study.

The qualitative component of the study involved two focus group interviews conducted with students that used smartphones for accessing the LMS in an online course. The guiding questions for focus group interviews that the focus group members had been asked were informed by the answers to the questionnaire administered in the quantitative phase of the study. A total of 27 students participated in the two focus groups. The focus group meetings were recorded to facilitate the transcription and analysis of the qualitative data. The qualitative analysis of focus-group interviews was used to analyze the data to identify general themes noted by the focus group participants as well as patterns within these themes.

3.2 Research Aims

The aim of this study was to investigate the use of smartphones by students in online higher education courses and the subsequent effect on students' approaches to learning and engagement. Another aim of the research was to develop insight into the way online students use smartphones and into how online courses might be restructured, thereby increasing student motivation and improving the online learning experience. This study recognized the importance and potential of mobile learning so that it might be more widely adopted as a mode of engaging students in learning activities.

The research questions were designed to address the identified gaps found in the literature, concerning the effectiveness of mobile learning and the pedagogical benefits it can bring.

3.3 Research Questions

The five research questions for the study were:

- **RQ_1:** To what extent do online students access their LMS using a smartphone?
- **RQ_2:** Is there a different learning approach taken by online students using a smartphone to access their LMS and that taken by online students who use other access mediums? In this context, the study will use the accepted outline of the three categories of deep, surface, and strategic approaches to describe the ways students

approach academic tasks (Marton & Säljö, 1997; Tait, Entwistle, & McCune, 1998; Trigwell & Prosser, 1991).

- **RQ_3:** Is there a difference in engagement between online students using a smartphone to access their LMS and online students who use other access mediums? In this context, student engagement is the contribution that students make toward their learning process including time, personal commitment, and resource contributions (Krause & Coates, 2008, as cited in Kahn, 2014).
- **RQ_4:** What are the specific tasks online students are trying to accomplish when accessing their LMS via smartphone?
- **RQ_5**: What are the underlying reasons why students access their LMS via smartphone?

3.4 Choice of Research Design

Several methodological choices are available for research designs. Far from basic deductive and inductive designs of the past, which limited the researcher to qualitative and quantitative methodologies, methodological designs today include mono-method designs, multi-method designs, and mixed-method designs (Cameron et al., 2015).

Given the nature of the research questions of this study, a mixed method research design has been adopted. This methodological choice is appropriate since some of the research questions can be best answered using quantitative methods, whereas other research questions demand qualitative methods for their clarification.

Mono-method designs allow the researcher to choose to use a single methodology of investigation in their research. Mono-method designs are either qualitative (textually based, and generally inductive) or quantitative (numerically based, and generally deductive) (Saunders

& Tosey, 2013). For this reason, a mono-method research design is inappropriate for this study, since it would limit the choice of this methods to either quantitative or qualitative ones. Saunders and Tosey (2013) point out that empirical research can take recourse to both deductive and inductive approaches. Thus, the mixed-method research design allows this study to both test research hypotheses deductively and to explore qualitative findings in an inductive manner.

Mono-method quantitative designs might use a survey that is analyzed statistically or a qualitative design that uses ethnography, or perhaps in-depth interviews (Saunders & Tosey, 2013). In multi-method designs, more than one design of the same type is used. For example, the researcher might choose to administer surveys as well as structured observations in a multi-method quantitative and qualitative study (Saunders & Tosey, 2013). A multi-method qualitative study might combine a focus group with an ethnographic approach (Saunders & Tosey, 2013). By combining two methods, it is possible to increase the validity of the results by examining the findings of the different methods together to more fully determine the relationships between the variables that were studied from different perspectives (Henseler, Ringle, & Sarstedt, 2015; Wakefield et al., 1998). Therefore, since this study seeks to validate its quantitative finding with qualitative insights, rather than answer separate, unrelated sets of research questions using different research methodologies, it has used a mixed-method design.

Mixed-method designs combine a minimum of one qualitative and one quantitative study method. Terrell (2012) suggested that when choosing a mixed-method design, the theoretical perspective should be considered. The theoretical perspective can be explicit (and based directly on existing theories) or implicit and based indirectly on theory (Terrell, 2012). The priority of the research strategy must be a consideration; thus, a decision must be made concerning which research design portion has the priority: the quantitative portion, the qualitative portion, or whether they are of equal standing. The sequence of data collection would then be implemented from the priorities: qualitative first, quantitative first, or no preferred sequence (Terrell, 2012). The final decision occurs when the data is integrated: at the collection, at analysis, at interpretation, or in some combination.

This investigation employed the sequential explanatory strategy (QUAN -> qual). This holistic research and data collection method places emphasis on quantitative data collection in the first phase of research. A second, qualitative phase is used to build on insight and nuances revealed through the first phase, acting as a methodological triangulation strategy. Once these two portions have been completed, interpretation takes place.

More specifically, research questions 1 to 3 were answered on the basis of closed questionnaires in the framework of the quantitative research paradigm, to assess the degree to which research participants access LMS using smartphones, various dimensions of their learning approaches, such as deep, surface, and strategic ones, and different aspects of student engagement, e.g., skills, emotional, interaction and performance engagement. Research questions 4 and 5 were answered using qualitative research methods, such as focus groups, because they allow an exploratory inquiry through guiding interview questions of specific tasks accomplished, possible barriers and underlying reasons for using a smartphone for LMS access over some other device (e.g. desktop, laptop, tablet).

The sequential explanatory strategy establishes clear stages for the research and, in this regard, helps to organize the research. It is far easier to analyze and develop results than would be possible for concurrent research strategies (Guetterman, Fetters, & Creswell, 2015; Terrell, 2012). However, there is one chief weakness. This method is very time-consuming.

Terrell (2012) pointed out that when both phases are given equal time and priority, it is particularly time consuming.

Since this research studies how students feel at a given point in time, it is a cross-sectional study. Questions or problems that are being asked during and regarding a point in time are considered a “snapshot in time” and are cross-sectional studies (Saunders & Tosey, 2013). The methodological choice to use the cross-sectional research design, thus, makes it unnecessary to follow a sample of research participants over time, which is characteristic of longitudinal studies.

3.5 Theoretical Framework

It is not enough to merely decide to do a study or even to decide to do a particular type of study. Instead, the theory behind each part of the methodology must be considered to produce a methodologically sound and well-informed study. The concept of research as an onion was described by Saunders, Lewis, and Thornhill (2009). In the view of Saunders et al. (2009), the research plan is the first layer of the onion. Once it is peeled away by establishing the philosophy or ontology, the next layer of research can be decided on. By the time the center of the onion is reached, five layers of research methodology have been established. This method of planning was followed for this research.

3.6 Research Philosophy

A research philosophy defines the knowledge to be investigated or acquired (Bryman, 2012). The assumptions generated by the philosophy provide justification for the manner of conducting the research. Understanding of a research philosophy enables researchers to determine the compatibility of the research methods to the research questions at hand.

There are two opposing research philosophies in relation to which particular research methods can be selected: constructivism and positivism (Pascarella, Seifert, & Blaich, 2010; Saunders, Lewis, & Thornhill, 2009). Positivism assumes a different reality from the one being studied. It alludes to the fact that there is a relationship that is consistent between subjects. Constructivism, on the other hand, assumes that the meaning of phenomena is derived by the group or party undertaking the research (Rosen et al., 2011; Östlund et al., 2011).

This research followed a positivist paradigm. Creswell (2009) pointed out that this approach is associated with quantitative rather than qualitative research methods because it provides a conceptual framework for using empiricism, determination, reductionism, and theory verification. The research methods selected for the quantitative part of this study position this research in a theoretical proximity to the positivist paradigm.

Empiricism or empirical observation and measurement were likewise applicable to this study. As Hunt (1994, p. 224) points out, “all propositions must fall unambiguously into one of

three mutually exclusive categories: cognitively meaningful and true, cognitively meaningful and false, or meaningless 'empty talk.'" The goal of the research was to be cognitively meaningful and true.

In the framework of a positivist paradigm, it could be assumed that a deterministic approach could establish causation based on a study (or meta-analysis of other studies), while offering deterministic explanations with possibly reductionist epistemological implications (McKelvey, 1997). For a critical realist or post-positivist perspective, causal interrelations need not be approached deterministically, which also demands the questioning of previous research results and conclusions. In other words, the post-positivist paradigm posits that alternative explanations are possible for empirical interrelationships and that causal relations can be approached non-deterministically (Tikly, 2015). Nevertheless, for both positivism and post-positivism, the replicability of empirical studies can serve as an indicator of their validity. This justifies the selection of the positivist paradigm as a methodological basis for the quantitative methods employed in this study.

Reductionism was not considered for this study. Glynn and Scully (2010) define reductionism as an attempt "to explain every complex phenomenon, by analyzing the simplest, most basic physical mechanisms that are in operation during that phenomenon" (p. 5).

The concept of reducing the data to bite-sized portions is not valuable when investigating social issues because the goal is to study the phenomenon. Thus, reductionism was rejected.

Positivism shaped this research most and focused the understanding of the relationships between theory and values. Positivism typically uses empirical observation and measurement (Creswell, 2014). Since the goal of this research was to investigate students' possible approach to online learning and engagement differences, if they existed, when using their mobile phones, the methodology of this study partially followed the positivist paradigm, since quantitative research methods were utilized for that purpose. The selection of mixed-method research design via survey and focus group research methodologies enabled this study to account for the

limitations of respective research methods within the boundaries of the positivist paradigm (Creswell, 2014).

A research paradigm is chosen depending on the researcher's view of what the real-world truth is (ontology) and how one knows it to be the real truth (epistemology) (Popkewitz, 1984; Robson & McCartan, 2016). Whereas the post-positivist approach comprises the efforts in the past few decades in response to the criticisms of positivism, positivism remains a valid paradigm for empirical research. Epistemology poses the following questions: What is the connection between the knower and what is known? How would we know what we know? What is knowledge? For positivism, which is largely based on a nineteenth-century philosophical approach, the reason for research is logical clarification. As indicated by Neuman (2007) positivism sees social science as an organized strategy for merging a deductive rationale with precise experimental perceptions of personal conduct, keeping in mind the end goal to find and affirm a set of probabilistic causal laws that can be utilized to anticipate general examples of human action. For positivists, exact realities exist, separate from individual thoughts or considerations; they are administered by laws of cause and effect; examples of social reality are stable and knowledge of them is added substance (Crotty, 1998; Neuman, 2007; Marczyk, DeMatteo, & Festinger, 2005).

Ulin, Robinson, and Tolley (2004) comment that the objective of science is to utilize the most adequate research techniques conceivable to obtain the most adequate picture of reality. Researchers who work from this point of view clarify in quantitative terms how factors connect, shape occasions, and cause results. They regularly create and test these clarifications in trial considerations. Multivariate investigation and methods for measurable forecast are among the salient features of this sort of research. This system assumes dependable knowledge depends on direct perception or control of regular phenomena through exact, frequent testing (Guba & Lincoln, 2005; Neuman, 2007).

Given that research questions of this study sought not only to explore interrelations between research variables based on measurement scales validated in previous studies (Handelsman et al., 2005), which corresponds to quantitative research approaches, but also to

inquire into the descriptive aspects of m-learning and underlying causes of student engagement, this study also employed qualitative research methods, such as focus groups (Robson & McCartan, 2016). This use of mixed methods in this study derives from the incompatibility of qualitative and quantitative research paradigms, even though both qualitative and quantitative methods can be equally rigorous. Furthermore, a pragmatic application of qualitative research methods brings them into the methodological proximity to positivism, especially since qualitative and quantitative research designs can be used to mutually validate their findings (Creswell, 2014; Robson & McCartan, 2016).

3.7 Research Strategy: Survey and Focus Group

Research strategies can include conducting experiments, taking surveys, doing archival research, conducting case studies, ethnography, action research, grounded theory, and narrative inquiry (Caldarella et al., 2010). More than one strategy can be used when designing research. The strategies serve to address how the research will go about answering the research questions. In the current study, two strategies were used. The first strategy, a quantitative one, used a survey.

The second, qualitative strategy used interviews to collect data in a focus group format. Focus groups can be in-person group interviews, or they can be Internet or Intranet-mediated or telephonic group interviews (Saunders, Lewis, & Thornhill, 2009). In this study, surveys were carried out through a questionnaire which was analyzed to discover student approaches to learning and engagement differences with smartphone utilization. Information gathered in the survey was then used to direct the lines of inquiry in the focus groups.

3.7.1 Surveys

The framework of the survey was constructed based on two well-validated survey tools. Several of the questions from each survey instrument were textually modified to fit the context of this online student research. First, to identify students' approach to learning, several

questions from the Learning and Studying questionnaire developed by the Edinburgh University Centre for Teaching, Learning and Assessment were modified to fit the online context of this research.

The selection of relevant items from this questionnaire for quantitative assessment of learning and course experience is justified by its prior validation by empirical studies of learning strategies in learning environments that this study also investigates (Tait & Entwistle, 1996). Furthermore, the validity of this questionnaire was found to be robust across different student groups, geographical contexts and socio-economic backgrounds, as similar dimensions of learning approaches have been found in different contexts (Entwistle, Tait, & McCune, 2000). This indicates the appropriateness of this measurement scale for this project.

The Approaches and Study Skills Inventory for Students (ASSIST) questionnaire originally developed by Tait, Entwistle and McCune (1998) has survey questions specifically addressing deep, surface, and strategic learning approaches (see Appendix 2). This has constituted the reason for choosing this inventory for the present survey based on its research priorities.

Additionally, this investigation adapted the Student Course Engagement Questionnaire (SCEQ) developed by Handelsman, Briggs, Sullivan and Towler (2005) because it was found to be reliable over four dimensions: “skills engagement, participation/interaction engagement, emotional engagement, and performance engagement” (p. 184). Given that the SCEQ measurement scale was found to be valid and reliable for various dimensions of student engagement in technology-mediated learning environments both by Handelsman et al. (2005) and multiple more recent studies (Henrie, Halverson, & Graham, 2015; Manwaring et al., 2017), relevant items from this questionnaire have been selected, in order to measure four types of student engagement as well as an aggregated total student engagement score in the present research (see Appendix 3), which corresponds to the research questions of this study. Handelsman et al. (2005) proposed that student engagement is comprised of four factors: skills engagement (study habits, organization); emotional engagement (applying content to one’s life, truly desiring to learn the material); participation/interaction engagement (participation in discussions with peers and faculty); and performance engagement (earning a good grade).

However, the SCEQ was designed to address face-to-face course engagement of students and many questions were not applicable to the online environment. To help transition the SCEQ to fit the context of this research, in this study Dixson's (2010) adaptation of the SCEQ was used as a guiding template on the basis of which the principal investigator has constructed survey questions that are more applicable for appropriately addressing the online learning environment of the investigated student population.

The first 15 questions of the survey directly addressed the four subscales of student engagement. Questions 16–27 were taken from the questionnaire on the Learning and Studying developed by the Edinburgh University Centre for Teaching, Learning and Assessment to address the three subscales of approaches to learning. The remaining surveys questions (28–32) are categorical questions for analysis classification. For example, "Have you used your smartphone to sign in to your online classroom?," and "How often do you use your smartphone to sign in to your online classroom?"

Following organizational and ethical approval, the survey was conducted online through personalized direct email of institutionally approved student emails. See Appendix 4 for an example of the email messages directly sent to the students' email address.

3.7.2 Focus Groups

Kitzinger (1995) explained that focus groups could be an effective method of discovering opinions, as they are a form of interview, conducted in a group. Krueger and Casey (2009) reported that input from some number of individuals representing one or more stakeholder groups is more easily obtained through focus groups. Focus groups have an efficiency of scale in terms of the efficiency in getting information from several people. In many cases, members of the focus group can help facilitate group interaction by stimulating ideas and observations. Focus groups can bring together people that have knowledge and interest in a subject area, under the supervision of a group facilitator.

The advantage of including a focus group element in this study was the ability to record "naturalistic" interaction between participants and to observe how they agreed and disagreed regarding their personal experience and views of using smartphones for online study (Flavin, 2017; Jarrett, 1993). It was expected that the social comfort and "solidarity" of a focus group could help provide information regarding that social construction like how students use smartphones in online studying (Green, Conkey, & Challoo, 2015; Kissling, 1996).

Furthermore, the addition of a focus group has assisted with mitigating the power dynamic bias often found within one-to-one interviews, which can also affect the validity of online survey results (Finch, 1984; Jong & Jung, 2015). Thus, this study utilized the methodology of focus group research, due to the collaborative and interactive nature of m-learning, such as in discussion groups, and in correspondence to its research questions. By contrast, conducting individual interviews would have precluded the element of interactive discussions from the present qualitative research process.

However, Kitzinger (1995) also explained that focus groups possess some inherent disadvantages. Often, the response to focus group invitations is low. Even if the individuals invited are present, some participants decline to talk or give answers. Other participants may be unduly affected by others. When there is a very active or strong personality in the group, it may be difficult to keep the group on the topic (Dulemba, Glazer, & Gregg, 2016; Witkin & Altschuld, 1995).

If the researcher is not vigilant, a negative dynamic can develop if there is a disruptive or bullying personality in the group (Ritchie, Lewis, Nicholls, & Ormston, 2013). If this is the case, then the group may be inundated with negative comments regarding the project, how the researcher looks, acts, or behaves, how the room feels or looks, what other participants look or act like and so on. Disruptive participants can even derail the aim and purpose of the group discussion (Ashcraft, Eger, & Scott, 2017; Witkin & Altschuld, 1995). There is potential for conflict in politically volatile situations and the lack of confidentiality in-group settings.

Substantial preparation is paramount to fully use the strength of a focus group (Morgan & Krueger, 1998). As a result, the researcher had conducted extensive preparations to deal with

a variety of issues and to have a plan regarding possible disruptions. In the course of qualitative data collection, the researcher facilitated the group with the assistance of an individual who set up an audio recording device, provided snacks and soft drinks and helped students feel comfortable. In this respect, the principal investigator has sought to maintain the anonymity of focus group participants, explain his researcher autonomy from the university at which this research was conducted and clarify the ethical guidelines with which this part of data collection that involved human subjects conformed. The number of focus groups conducted, and number of attendees are addressed in 3.10.3.

3.8 Transcribing, Coding, and Analysis Methods

After the data were collected in the form of focus group recordings or survey responses, they were analyzed. The first step in the processing of the survey data was to calculate the total responses in each category for each answer. The first step in the processing of the focus group data was to transcribe the data. The following sections describe the method of processing the acquired data in both portions of the study.

3.8.1 Survey Analysis

In interpreting the survey results, a combination of factor analysis, ANOVA, MANOVA and logistic regression tests were used because they were statistically appropriate given the type of data collected. ANOVA and MANOVA are methods of comparing differences of means or averages. ANOVA tests differences in means between two groups or more. MANOVA, or multivariate analysis of variance, tests for the difference in two or more means vectors (Blunch, 2016; Dunteman, 1984).

MANOVA can be used to determine the main effects of independent variables, the interactions among independent variables, the strength of association between dependent variables, and effect of covariates, as well as how the covariates can be used (Attewell & Monaghan, 2015; Dunteman, 1984). MANOVA also reveals differences that ANOVA cannot, but

it is more complex than ANOVA. MANCOVA, an extension of ANCOVA, is the same as MANOVA except that dependent variables are adjusted for differences in covariates (Schulte, 2016; Dunteman, 1984). MANOVA works best when there are moderate correlations between the dependent variables. When the dependent variable correlation is very high or very low, it is not suitable (Docampo & Cram, 2015; Tabachnick & Fidell, 1996). In addition, both ANOVA and MANOVA are very susceptible to outlier data, so outliers were determined before ANOVA and MANOVA were used.

ANOVA and MANOVA tests assume there is a normal or near normal data distribution: this assumption is behind the major argument against their validity. For example, if the research looked at student test scores between two courses, the assumption would be made that test scores in each course would be distributed in a bell curve. If the data follows that pattern, then the ANOVA and MANOVA would be appropriate. However, if it is clear there are outliers after the outlier tests, then nonparametric tests would need to be performed.

Non-parametric data are those that make no assumptions about the population. Parametric data (such as in ANOVA and MANOVA tests) assume knowledge of the characteristics of the population, to make inferences and even generalizations. In accordance with a postmodernist paradigm, nonparametric testing does not attempt to make distributional assumptions and thus may be better suited for many kinds of social science research.

3.8.2 Focus Group Analysis

The first step was to transcribe the recording of the focus group. The choices were to transcribe it verbatim or to transcribe salient portions. Given that it is very difficult to determine what is salient before it is analyzed, the entire discussion portion of the recording was transcribed. Background noises were noted in the transcript, along with interruptions and silences (Lewis-Black, Bryman, & Liao, 2004).

Transcription began at the end of the second focus group. After the collection was complete, the researcher developed coding categories in preparation for thematic analysis used

in analyzing the data. Initial coding was conducted by generating textual codes as the transcript was read.

Berkowitz's (1997) work guided the coding process, while Bogdan and Biklin (1998) provide a method of determining codes during the process. The questions adapted from Berkowitz and used to guide the data processing were:

- Were there any common themes that seemed to relate to specific topics?
- When there seemed to be deviations, what accounted for them?
- Did a difference in student demographic seem to make a difference in response?
- Did age seem to make a difference in response?
- Where there any anecdotes that emerged and that helped inform the central question?
- Do any of the patterns suggest areas for future research, and if so, what?

The researcher's adaptation of Bogdan and Biklin's (1998) suggestions for processing code included:

- developing codes to describe the background setting or subjects;
- defining codes to describe the students' general world views;
- developing codes that express the way the students define the setting;
- providing codes for words that describe how students look at others (e.g., a nerd, a geek, a jock);
- developing process codes that show how things have changed over a period;
- identifying activity codes that will categorize recurring behaviors (e.g., rude, loud, accepting);

- providing event codes that will highlight important events to respondents (e.g., university ISP was down for three days, library blocked access to some websites and so on);
- identifying codes that describe how instructors relate to the way students study or learn
- developing social or relationship codes to identify students who are friends, who met online and so on;
- providing method codes to identify points that the researcher believes highlight breakthroughs or important points.

This process is essentially the physical process that would be accomplished using NVivo or other qualitative coding software (Bogdan & Biklin, 1998). These processes were followed throughout the coding procedure (Appendix 7). After the second initial coding, the researcher used focused coding to combine coding categories. In this process, the researcher searched for connecting topics that would connect codes with few utilizations, while codes with large numbers of responses were scrutinized to see if they should be subdivided. The number of final codes was condensed to 13, with 4 categorical themes.

3.9 Data Samples and Data Collection

The survey responses were collected through the survey software called Snap. The focus groups met with the researcher and an assistant.

3.9.1 Survey Sample Sizes

All student samples were generated from the online undergraduate student body of the researcher's regionally accredited US private university. They currently have a student population of around 14,000 graduate and undergraduate students attending the local campus, with a separate population of around 65,000 doctoral, graduate, and undergraduate students attending online. The university offers a wide range of programs in the STEM disciplines as well

as business, education, psychology, healthcare, and the performing arts. Nevertheless, the results of the present study are likely to be specific to either universities with similar curricular characteristics or educational institutions that deploy mobile learning to a similar extent. Moreover, especially students attending their academic courses online can be expected to be affected by their contexts, as far as measurement of research variables and qualitative research results are concerned.

The survey group followed a census sampling technique to elicit responses from undergraduate students attending university exclusively online (Pandey & Singh, 2015; Bogdan & Biklen, 1998). Therefore, the findings of this study may be particular to this research participant population. Separate empirical investigations of m-learning among graduate, vocational and continuing education learners may be necessary to explore the empirical boundedness of the present findings. A variety of sampling methods could have been used, including true random sampling in which each student in the university would have an equal chance of being selected for the study (Creswell, 2009). These methods were not used, however, because the researcher had university approval and the technological capacity to send the survey invitation to the university's entire online undergraduate population. Care was taken to determine whether the respondent population would reflect the demographic profile of the total target population. The researcher was prepared to send multiple rounds of survey invitations until a representative sample was achieved. However, the initial respondent sample appropriately reflected the target population demographic profile, which will be discussed in chapter 4.

Emails were sent out to 24,550 undergraduate students, a number that represents the university's entire online undergraduate population. There were 24,550 possible responses; 31.54% unique emails were opened with a click-through-rate (the survey link within the email body was clicked) of 9.3%, which yielded 1,843 total respondents who completed the survey. The final response rate was 7.51%. Figure 5 shows the delivery rate of the email offerings.

There were 15 total bounces, with 24,550 emails reaching delivery for a delivery rate of 99.93%. In email invitations, when an email bounces it means the email was not delivered to

the indicated email address. A soft and block bounce means the email address is valid, but the email invitation was not delivered because the intended recipient's inbox was full, or the server was down, or blocked by server protection. A hard bounce occurs when the email address is invalid.

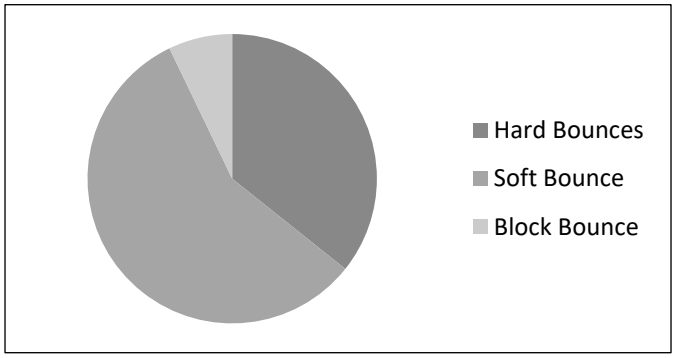

Figure 2. Percentage of Survey Offers that Bounced

3.9.2 Survey Procedures

The researcher's university uses purchased survey software called SNAP, which gave the researcher the flexibility to collect a unique student identifier and tie the identifier to student-related institutional data while allowing the respondents to remain anonymous. The researcher programmed in each of the questions and worked collaboratively with the university's marketing department. The marketing department was able to identify the appropriate target audience and it sent email offerings to the university's online undergraduate students exclusively. Additionally, the marketing department could embed the student's ID number into each email offering, allowing the researcher to use additional institution data linked to each ID number. Each email included a YES and NO button indicating if the student wished to participate in the survey. If the respondent answered YES, the program gave the introduction, which included an informed consent request and notified the student that if they continued, they were giving consent. The student was given information about how to contact the researcher if he or she wished to see the results of the investigation.

The survey was designed to ask one question at a time. In addition, students were allowed to answer part of the survey, save, and come back at a more convenient moment to complete the survey.

The questionnaire contained two thematic subscales: engagement and approaches to learning. To validate internal consistency of this construct and scaled scores, the researcher first sent the survey to 1000 random online undergraduate students attending the researcher's university in the framework of a pilot study that preceded the procedures of data collection. Determining internal reliability is paramount because in the absence of reliability it is impossible to have any validity associated with the scores of a scale (Creswell, 2009). Within a three-day period, 361 students responded. These 361 respondents were used to determine whether the survey instrument's subscales were reliable measures or whether necessary adjustments needed to be made.

The engagement subscale consisted of 15 items, and the approaches to learning subscale consisted of 12 items (see Appendix 3). Cronbach's alphas for the 15 engagements and 12 approaches to learning items were .84 and .66 respectively. Nunnaly and Bernstein (2010) assert that .70 can be an acceptable minimum for newly developed scales. Although most questions within the approaches to learning subscale were adapted from the Learning and Studying questionnaire from the Edinburgh University Centre for Teaching, Learning and Assessment, the researcher felt it necessary to remain strict in determining internal reliability and validity as if the approaches to learning subscale were an entirely new scale. Thus, a Cronbach's alpha of at least .70 was needed to validate the reliability of this subscale.

The item correlations for two items within the approaches-to-learning subscale were anomalously low; therefore, the decision was made to remove these two items (item 21 and 23), which resulted in a corresponding increase in Cronbach's alpha for the approaches-to-learning subscale to .73 and a total item count of 10. Although these items were omitted from future analyses within the approaches to learning subscale, they were not removed from the final survey instrument sent to the researcher's remaining online undergraduate student population.

The results of the pilot gave merit to the survey's construct validity and reliability, so the decision was made to proceed in emailing the survey to the remaining online undergraduate population.

3.9.3 Focus Group Sample Sizes

The students selected to participate in the focus group were chosen from the group of online students. However, the sample size of each focus group was calculated in a different manner. Focus groups are conducted in a qualitative fashion, with emphasis on achieving saturation rather than on a set calculation for sample size. There is no real guidance as to the sample size for focus groups; Krueger and Casey (2009) pointed out that even a group of two might be adequate. A group of more than a dozen would be difficult to organize and to ensure that everyone was heard. Thus, if more opinions were desired, it would be more appropriate to have more groups. The final decision was made to have two focus groups, consisting of about 10 students each. The focus group samples were selected from the population of students who responded to the email survey and also answered "Yes" to using their smartphone to access their online classroom. An email invitation was sent to this population of survey respondents asking if they would be interested in participating in a university-approved research study about smartphones. Thirty-six students responded affirmatively and two session date/times were disseminated. Fifteen students attended the first focus group and twelve attended the second session.

3.9.4 Focus Group Process

Focus groups engage in a discussion of research-relevant themes, while being led by a facilitator (Dean & Bowen, 1994). The researcher anticipated that the focus groups could provide latent insight into and descriptions of the use of smartphones, information which might not be obtainable through the singular use of a survey. The general format of the focus group

was adapted from materials taken from relevant scholarly literature (Wilkes, Nobe, Clevenger, & Cross, 2015; Berkowitz, 1996; Witkin & Altschuld, 1995).

The researcher developed a questionnaire-based focus group protocol in the form of a list of topics and questions, which were covered in the focus group sessions. These questions discussed during focus group sessions were also guided by the data analysis of the quantitative survey results. The protocol was designed to have questions that would stimulate group conversation on the topic, would build on the next question or questions, and would keep the group's interest in the topic so that exploration was fluid. The general pattern the researcher established for the protocol follows, although once the conversations were well under way, the protocol was no longer needed.

In the introductory portion of the meeting, the researcher and the aide greeted the group and explained the purpose of the session. An informed consent form (Appendix 8) was distributed and signed and the rules of the group were discussed, which included keeping these discussions confidential. Students were introduced using the names on their name cards and could talk briefly about what classes they were taking, whether they were married or single, had children and so on. The introduction provided background information in demographics for the researcher, while helping the students get to know each other and relax.

The researcher introduced the topic and the idea of using smartphones for online education and for engagement in the learning process. The participants were asked two main questions: first, in the instances when they used their smartphone to sign in to their online classroom, why did they choose to use their smartphone rather than another device, and two, what specific tasks did they do on their smartphone when they used them to sign in to their online classroom?

Finally, the researcher-moderator summarized the discussion that had taken place. Students could ask for clarification of any topics discussed, and to provide final comments or questions. The students were advised about how they could receive copies of the study when it was completed.

3.10 Triangulation and Validity

The triangulation and mitigation of the weaknesses of surveys and individual interviews were a consideration that resulted in the choice to continue the study with a student focus group. To mitigate methodological bias pointed out by Wakefield et al. (1998), data were triangulated through the use of more than one data collection method. Triangulation processes exist in the form of Data Triangulation, Investigator Triangulation, Methodological Triangulation, and Environmental Triangulation. Keeping a research diary and making it available to researchers who may wish to either review or replicate the study is an additional method of ensuring the research is both accurate and honest. For this research, the guidance of Phillips and Burbules (2000) was applied:

- The knowledge will be relative, but not absolute.
- A situation will be explored to satisfy claims about the situation.
- The data, research, and evidence will be used to build knowledge and potential research for the future.

Given that collecting the data without any real aim or purpose is useless as research (Walliaman, 2001); a plan is needed to develop the research. Based on the requirements established by Walliaman (2001) and Phillips and Burbules (2000) and the guidelines for the development of adequate research design (Saunders et al., 2009), all the important research approaches were considered and an appropriate method for the planned research chosen. To restate, a quantitative perception survey was initially used to find correlations, if they exist, of smartphone use in the online classroom environment and their effect on approaches to learning and engagement. After confirming the validity and reliability of the survey instrument via the pilot test study, the survey was then followed by a pair of focus groups to further investigate why and how students use their smartphones to access their online classroom (e.g., why they are using the smartphone over some other device and what education tasks they are doing in the online classroom environment via their smartphone).

The research work employed the use of the Inter-Rater Reliability format to be able to determine the point of agreement. An additional university researcher independently read and

coded the focus group comments (coding methods discussed in 4.3), to ensure the reliability of the qualitative findings of the present study. The agreement between the themes and categories presented was reached between the two researchers.

This holistic research and data collection method places emphasis on addressing specific research questions in the first phase of quantitative data collection and research. A second qualitative phase was used to build upon further insight and nuances revealed through the first phase. Essentially, the quantitative data was used to inform the qualitative data collection phase to further explain and interpret phenomena (Creswell, 2009). This strategy can be particularly useful when unexpected results arise from the first phase and for further explanatory and investigative research (Morse, 1991). This mixed-methods design used two different data collection methods: student surveys and two student focus groups. This two-phase approach is an attempt to collect holistic and unbiased data, utilizing the strengths of each approach and to cross-validate and triangulate the empirical results of each methodological approach.

3.11 Ethical Considerations

Research involving human subjects requires careful consideration of methods used to collect data and the way in which participants' rights are protected. There were issues that came up, such as the right to privacy, as there was personal information that the participants were asked to divulge. There was also the need for confidentiality of the information that was being shared by the participants. As part of the ethical considerations, it was agreed that privacy and confidentiality would be prioritized by storing the information in a secure database. An important part of conducting research involving human subjects is obtaining approval for the intended research methods through the appropriate ethics committee. The proposal for this study and the methods used were presented to at least two approved EdD supervisors and the International Online Research Ethics Committee governing this EdD (IOREC).

Ethical approval was obtained. Furthermore, all research participants provided informed consent, as part of their participation in this research project (Appendix 8).

The most important ethical consideration for this study was ensuring students who took part in the investigation were not harmed, personally or academically, and that confidentiality was protected in data collection and storage. All participating students were advised of their right to stop participation at any time or to choose not to answer any survey or focus group question (Creswell, 2012).

In the codified record of the focus groups, students were assigned an anonymous identifier to secure anonymity. The students that participated in focus groups were assured that their confidentiality would be maintained throughout this study.

Once the data collection phase was completed, the information acquired was highly protected and safeguarded by the researcher's personal offline password protected digital library. Once the data was encoded for analysis, all physical copies of participation forms were kept in a secure locked cabinet to provide additional protection to participants, ensuring individual responses could not be traced to any specific participant (Creswell, 2012).

Several general ethical concerns were also addressed. Care was taken to ensure that the students who participated did so voluntarily (Terrell, 2012). The purpose and procedures used were explained to the participants in writing, and orally, and they were asked to sign a release to show that they had understood these procedures. The students were notified that they had a right to have a copy of the results and informed that they could let the researcher know if they did want the results. The students received an explanation not only of what was being done but why it was being done (Appendix 4). In this way, they understood the potential benefits of the study, not only to their academic careers but also to the academic careers of future students.

During the study, the researcher took care to identify any point at which the student might perceive that the researcher had some type of power over them and to negate any perceptions before they became issues. One of the ways that this was accomplished was to ensure that anonymity was maintained while the data was being analyzed and that the data was kept for a reasonable period after completion of the study (Terrell, 2012). Other ways of ensuring

anonymity have already been discussed, such as the use of pseudonyms (Crow & Wiles, 2008, p. 1)

Rules of the American Psychological Association (APA), as presented in the most recent version of the APA Publications Manual (APA, 2010), were followed during the writing of the research questions and the development of the thesis and subsequent report. The APA's guidelines for reducing general bias were followed whenever possible. Finally, the study details were specifically presented in the report to allow readers to make their own judgments regarding the study, its contents, its procedures, and its ethical stances (Terrell, 2012).

3.12 Conclusion

This chapter addressed the methodology of the project. The guiding concept behind the methodology was to follow the layers of the research onion to ensure that all the necessary facets of the research were described (Saunders & Tosey, 2013). The researcher believes that knowledge is a fluid concept and changes with the time or situation. As a result, studying a different group of students might bring different results. To ensure the reliability of this study, the results of the survey and the focus group investigations were designed to be triangulated with each other as well as compared to the available literature.

The quantitative component of the study used a survey questionnaire constructed through modification of survey questionnaires developed by the Edinburgh University Centre for Teaching, Learning and Assessment and the SCEQ (Schumann, Wünderlich, & Wangenheim, 2012). The instrument contained a subscale for engagement and a subscale for approaches to learning.

The data collection approach for the quantitative phase of the study was conducted online with direct email solicitation of students and the use of SNAP software for collecting and aggregating the data. The sampling included only students taking online courses.

A pilot study was used to assess the reliability and validity of the survey instrument, with the pilot study collecting data from 361 students. Cronbach's alpha indicated that that

survey questionnaire was reliable after the removal of items with low correlations. Factor analysis was used to determine the validity of the subscales contained in the instrument. Subscales included scales for surface learning, deep learning, strategic learning, skill engagement, emotional engagement, participation/interaction, and performance engagement. Likewise, qualitative data has been collected from two focus groups and subsequently analyzed in light of the quantitative findings.

CHAPTER 4 FINDINGS AND ANALYSIS

4.1 Introduction

The study investigated quantitative aggregate variants through survey research, and inherent qualitative differences through focus group research on the effects smartphone devices have on students' approach to learning and engagement when these devices are used as a means of accessing and studying through an online management system.

Based on its literature review, this research defines approach to learning in terms of learning intentions, student motivations and studying strategies and tactics (Purdie, Hattie, & Douglas, 1996). In this study, student engagement is operationalized as the amount of time, resources and commitments that students dedicate to learning. Engagement is also construed in terms of intentional proactive involvement that students demonstrate in their student-to-student and student-to-instructor interactions in the course of learning activities (Krause & Coates, 2008).

In this study, the sample size was 1,843 students, with a response rate of 9.3%. Though this is a relatively low response rate, the present sample size is methodologically sufficient for conducting the following quantitative analyses. The data analyses of the survey questionnaire results comprised reliability analysis, factor analysis, ANOVA, and post-hoc tests.

The study found statistically significant differences between online students who indicated they used their smartphone to log into their LMS versus students who used other technological mediums (computer, laptop, tablet, etc.) to sign in to their LMS in Surface and Strategic approaches to learning (subscales of approaches to learning). The study also found statistically significant differences between students who indicated using their smartphone to log into their LMS versus students who used other technological mediums to sign in to their LMS in skills and emotional engagement (subscales of engagement). The study also found clear themes that students perform when using their smartphones in their online learning process.

The purpose of this chapter is to present the data analysis related to the five research questions formulated for this study. This chapter is divided between an examination of the quantitative data that were collected using the survey instrument and an examination of the qualitative data collected from the focus groups. For the quantitative analysis, the chapter begins with an examination of the data related to each of the three survey-based research questions. Appropriate statistical tests were performed to address each of the research questions. Then, following the quantitative analysis, the qualitative analysis is provided based on an examination of transcripts of the focus groups.

4.2 Quantitative Analysis

4.2.1 Survey Response Demographics

Before delving directly into the survey question results, it is important to understand the demographics of the survey respondents and to juxtapose survey respondent demographics with those of the target population.

Of the 1,843 students who responded to the survey, 80% were female with an average age of 39 and 20% were male with an average age of 40. This gender distribution appears consistent with the target population of the study. The institution's online undergraduate students are 76% female with an average age of 37 and 24% male with an average age of 36. This confirms that there is no significant gender or age bias in the survey results in terms of student population comparison versus that of the participating institution.

The student program category distribution percentages of the survey respondents also reflect similar program dispersions of the target population. Program category percentages for the survey respondents, from largest to smallest, are Education (31.78%), Health Care Professions (27.61%), Humanities and Social Sciences (16.73%), Business (16.23%) and Theology (7.65%). The program category percentages compared to the target population of the university are: Health Care Professions (33%), Education (28%), Business (18%), Humanities and Social Sciences (16%) and Theology (5%) (see Figures 7 and 8 below).

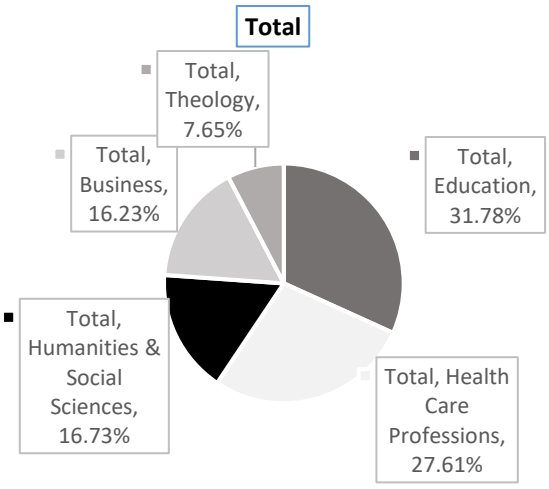

Figure 3: Survey Respondents Program Category Distribution of Online Undergraduate Students

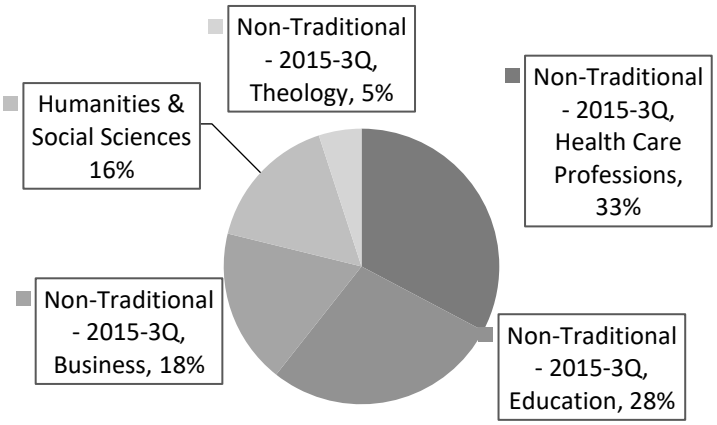

Figure 4: Institution Program Category Distribution of Online Undergraduate Students

The figure above shows the students participating in online learning in different programs and courses. More specifically, the above descriptive statistics indicate that the majority of research participants have been enrolled in courses of study in the fields of education and health care.

4.2.2 Research Question 1

The first research question for this study was: To what extent do online students access their LMS using a smartphone? Answering this research question required analyzing the descriptive statistics of the questions that asked the students to provide information about whether they owned a smartphone and whether they used a smartphone to sign in to their online classes. Table 1 presents the descriptive statistics for the three questions that were asked with "yes" or "no" responses. The frequency for each response category is shown, along with the percentage that each frequency constitutes based on the total number of valid responses to each question.

Table 1. Responses to Questions about Mobile Phone Usage

Responses to Questions about Mobile Phone Usage		
Question>Response Options	Number	Percent
Do you have a smartphone?		
Yes	1712	93.5%
No	119	6.5%
Have you used your smartphone for studying?		
Yes	1067	62.3%
No	647	37.7%
Have you used your smartphone to log into your online classes?		
Yes	1172	68.6%
No	536	31.4%

In response to the question, “Do you have a smartphone?,” 93.5% (n=1,712) of the participants indicated that they did have a smartphone. 6.5% (n=119) of the participants indicated that they did not have a smartphone. Based on this survey, it has been found that an overwhelming majority of the undergraduate population at the university had access to a smartphone.

The participants were also asked, “Have you used your smartphone for studying?” 62.3% (n=1,067) of the students who took part in this study and answered the question indicated that they had used a smartphone for studying. The larger indication is that about two-thirds of the undergraduate population at the university used their smartphones in some context to access learning materials and to communicate in the learning processes without having to use physical books and articles. Interestingly, in response to the question of “Have you used your smartphone to log into your online classes?” a slightly larger percentage of the undergraduate students, 68.6%, (n=1,172) indicated that they had indeed used their smartphones to log into their online classes. In this regard, more undergraduates at the university had used their smartphones to log into their online classes than had used their smartphones to engage in studying in general.

A subsequent question that arises is how often the undergraduate students who took part in this study indicated that they used their smartphones to log into their online classes. Table 2 shows the response frequencies and the percentages of students who provided a response to the question "How often do you use your smartphone to log into your online classroom?" Only 5.7% (n=97) of the participants indicated that they always log on to their online classes with their smartphones. However, 27.7% (n=473) of the participants indicated that they never use a smartphone to log into their online classes. Overall, 30.4% (n=519) of the participants indicated that they frequently or always log on to their online classes with their smartphones. In contrast, 45.1% (n=771) of the participants indicated that they never or very seldom log on to their online classes with their smartphones.

Table 2. Frequency of Use of Smartphone to Log into Online Classes

Frequency of Use of Smartphone to Log into Online Classes		
Question>Response Options	Number	Percent
How often do you use your smartphone to log into your online classes?		
Never	473	27.7%
Very seldom	298	17.4%
Occasionally	419	24.5%
Frequently	422	24.7%
Always	97	5.7%

Overall, based on the descriptive data of the participant responses to the questions about cell phone use, nearly half of the students never or very seldom used their smartphones to access LMS. More than one-quarter of the participants indicated that they never used their smartphones to log on to online classes at the university. In comparison, 30.4% (n=519) of the students indicated they frequently or always used their smartphones to access their online classes. Of this number, 24.7% (n=422) responded to the survey that they frequently logged onto their online classes with their smartphones. Based on the answers provided for all these questions, it appears the students at the university are clearly varied in the extent to which they access their LMS using a smartphone. There are as many students who frequently use a smartphone to access online classes as those that only do so occasionally or never. However, we can conclude that there are portions of online undergraduate students, according to this survey, who do use their smartphone to access their online classroom.

On the whole the descriptive statistics presented above indicate that the shares of respondents that have used their smartphones for m-learning (62.3%; n=1,067), completed specific learning-related tasks, such as logging into their LMS, (68.6%; n=1,172) and have used their smartphones for attending classes online occasionally and more frequently (54.90%; n=938) largely

correspond to each other. Therefore, this study has found a positive answer to the RQ_1 in that it has found that students access their LMS online using a smartphone to a significant extent. This finding does not appear to involve a Type I error, since different descriptive statistics largely corroborate each other.

4.2.3 Research Question 2

The second research question was whether there was an approach-to-learning difference between online students using a smartphone to access their LMS and online students who use a computer. To answer this question, the three subscale variables that were created were used: deep, surface, and strategic learning. For the deep approach to learning subscale, four questions were initially included in the subscale. For the surface subscale, four questions were initially included. For the strategic subscale, four questions were included. Table 3 shows the questions that were initially included in each of the subscales of learning. It must be noted that questions 21 and 23 were excluded from the surface subscale because the Cronbach's alpha for the subscale with those questions was less than 0.70.

Table 3. Survey Items Included in Learning Approaches Subscales

Learning Approaches and Subscale Items
Deep Learning Subscale
15. I seek to understand for myself the meaning of what is being taught
16. I try to make sense of things by linking them to what I know already
18. I look at evidence carefully to reach my own conclusion about what I'm studying
19. When reading course material, I try to find out for myself exactly what the author means
Surface Learning Subscale
20. Much of what I've learned seems no more than lots of unrelated bits and pieces in

my mind

22. I tend to take what is taught at face value without questioning it much

Strategic Learning Subscale

24. I manage to find conditions for studying which allow me to get on with my studying Easily

25. I create a study schedule

26. I pay attention to what my instructors seem to think is important and concentrate on that

27. I look carefully at instructors' comments on my assignments to see how to get a higher score next time

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These subscales were created by using the related questions that were asked on the survey and then performing a reliability analysis to determine if the questions included in each subscale were internally consistent, meaning that they were related to each other. An initial pilot test was conducted using the first 361 surveys that were returned to determine if any question should be omitted from the learning subscales. To include a question in each scale, a Cronbach's alpha of 0.70 or higher was required because this is generally considered the minimally appropriate level of reliability (Bryman, 2012). Questions 21 and 23 were excluded from the surface subscale because the Cronbach's alpha for the subscale with those questions was less than 0.70.

A factor analysis was also performed to determine if these questions were appropriately related to each other. Any item with a factor loading of less than 0.40 was excluded. As shown in Appendix 5, the KMO test showed a measure of sampling adequacy of 0.836. In addition, the results of Bartlett's test of sphericity showed the null hypothesis and correlation matrix between the items was an identity matrix and could be rejected. Consequently, the alternative hypothesis that the correlation matrix between the items was not an identity matrix could be accepted (Chi-Square = 4946.752, df=45, $p<0.001$). Based on these results, it was concluded that the subscales and the individual items in the subscales were appropriate.

To answer the research question, an ANOVA was performed with the variable of "How often do you use your smartphone to sign in to your online classroom?" as the dependent variable, and the subscale variables for deep, surface, and strategic as the independent variables. The null hypothesis for the ANOVA is that there is no statistically significant difference in learning approaches of the students based on how often they use their smartphones to sign in to their online classes. The alternative hypothesis is that there is a statistically significant difference between the learning approaches based on how often they use their smartphones to sign in to their online classes.

The results of the ANOVA are shown in Table 4. The results showed that for the deep learning approach, there was no statistically significant difference in learning approach for the participants based on how often they used their smartphones to sign in to the online classroom. However, the results showed that there was a statistically significant difference with regards to the strategic learning approach for the participants based on how often they used their smartphones to sign in to the online classroom. The results in Table 4 also showed that there was a statistically significant difference with regard to the surface learning approach for the participants based on how often they used their smartphones to sign in to the online classroom.

Table 4. ANOVA for Learning Approaches Subscales

Subscale		Sum of Squares	df	Mean Square	F	Sig.
DEEP	Between Groups	20.255	4	5.064	0.85	0.494
	Within Groups	9767.022	1639	5.959		
	Total	9787.277	1643			
STRATEGIC	Between Groups	79.987	4	19.997	2.71	0.029
	Within Groups	12204.35	1654	7.379		
	Total	12284.338	1658			
SURFACE	Between Groups	78.1	4	19.525	7.158	0.000
	Within Groups	4506.273	1652	2.728		
	Total	4584.373	1656			

Based on the results of the ANOVA, there are significant differences in the learning approaches of the participants in terms of how often they use their smartphones to sign in to their online classes. In relation to the second research question, the present study indicates that the frequency of the LMS use over the smartphone is not related to deep learning, but is significantly interrelated to both strategic and surface learning. These findings in relation to deep learning do not appear to involve Type II error, as the null hypothesis was accepted based on the high p value (0.494). Similarly, the findings in relation to strategic and surface learning are not likely to involve Type I error, as the null hypothesis was rejected based on the lower p values (0.029; 0.000) respectively.

Since the significant differences are related to strategic and surface learning approaches, the question that arises is where differences exist in terms of how often students sign in to their online classes on their smartphones. To answer this question, the post-hoc test of least significant difference (LSD) was performed. This test is a t-test in which differences between the means of each response category of the factor are compared, which in this case is how often the students indicated that they signed on to their online classes on their smartphones.

Table 5 shows the results of the LSD test for each of the response categories for both the strategic and surface subscale variables. Any category with a significance of 0.05 or less indicates that the mean difference from the other response categories is statistically significant (Weinberg & Abramowitz, 2002). The results show that for the strategic subscale, the only response category that was statistically significantly different from the others is the “always” response, which allows rejecting the null hypothesis that no difference exists, whereas the low p value levels (0.002-0.007) indicate a low probability of Type I error. This was also true for the surface subscale variable, in which case a very low probability of Type I error was found as the low levels of p values (0.000) have allowed to reject the null hypothesis. The fact that the mean score for the always response for both subscale variables is larger than the other mean values translates to students who indicated that they always use their smartphones to sign on to the online classroom had a higher strategic learning and surface learning approach than the

students who never, very seldom, occasionally, and frequently used their smartphones to sign on to the online classroom.

Table 5. ANOVA Results for Approaches to Learning Subscales

Subscale			Mean Difference	S.E.	Sig.
STRATEGIC	Never	Very seldom	-7.51E-02	0.2041	0.713
		Occasionally	5.32E-03	0.1852	0.977
		Frequently	3.11E-03	0.1841	0.987
		Always	-0.9529	0.3075	0.002
	Very seldom	Never	7.51E-02	0.2041	0.713
		Occasionally	8.04E-02	0.2095	0.701
		Frequently	7.82E-02	0.2085	0.708
		Always	-0.8778	0.3227	0.007
	Occasionally	Never	-5.32E-03	0.1852	0.977
		Very seldom	-8.04E-02	0.2095	0.701
		Frequently	-2.21E-03	0.1901	0.991
		Always	-0.9582	0.3111	0.002
	Frequently	Never	-3.11E-03	0.1841	0.987
		Very seldom	-7.82E-02	0.2085	0.708
		Occasionally	2.21E-03	0.1901	0.991
		Always	-0.956	0.3104	0.002
	Always	Never	0.9529	0.3075	0.002
		Very seldom	0.8778	0.3227	0.007
		Occasionally	0.9582	0.3111	0.002
		Frequently	0.956	0.3104	0.002
SURFACE	Never	Very seldom	-4.33E-02	0.124	0.727
		Occasionally	-0.1158	0.1125	0.304
		Frequently	-0.1921	0.1125	0.088

Subscale			Mean Difference	S.E.	Sig.
		Always	-0.959	0.1846	0.000
	Very seldom	Never	4.33E-02	0.124	0.727
		Occasionally	-7.25E-02	0.1271	0.569
		Frequently	-0.1488	0.1271	0.242
		Always	-0.9157	0.1938	0.000
	Occasionally	Never	0.1158	0.1125	0.304
		Very seldom	7.25E-02	0.1271	0.569
		Frequently	-7.64E-02	0.1159	0.510
		Always	-0.8432	0.1867	0.000
	Frequently	Never	0.1921	0.1125	0.088
		Very seldom	0.1488	0.1271	0.242
		Occasionally	7.64E-02	0.1159	0.510
		Always	-0.7668	0.1867	0.000
	Always	Never	0.959	0.1846	0.000
		Very seldom	0.9157	0.1938	0.000
		Occasionally	0.8432	0.1867	0.000
		Frequently	0.7668	0.1867	0.000

The results indicate that the difference in the learning approach of students based on how often they use their smartphones to access the online classroom is based on strategic and surface learning. The participants in this study who always accessed the online classroom on their smartphones had higher scores on the surface and strategic learning as compared to the other participants. There was no significant difference, however, involving deep learning.

Another way to examine the research question of whether there is a difference in learning approaches among students who use smartphones to access the online classroom is to perform a logistic regression using the data from the question of “have you used your smartphone to sign in to your online classroom” as the dependent variable. This question

allows for the complete separation of students who used their smartphones to sign in to the online classroom in any way as compared to those students who did not use their smartphones to sign in to their online classroom.

Logistic regression was required because the dependent variable is a dichotomous variable, meaning it only has two response choices, either “yes” or “no.” The independent variables for the logistic regression were the variables created for the learning subscales of deep, surface, and strategic.

Table 6 shows the results of the logistic regression analysis. The null hypothesis for the regression is that the independent variables were not significant predictors of the dependent variable. The alternative hypothesis is that the independent variables were significant predictors of the dependent variable. Any independent variable with a p-value of less than 0.05 was determined to be a significant predictor of the dependent variable. Unlike the results with the ANOVA, the results of the logistic regression showed that none of the three learning approach variables were significant predictors of whether the participants had ever used their smartphones to sign in to the online classroom. Given the relatively high p values for all of the examined learning approaches, the probability of Type II error was relatively low, as in each case the null hypothesis was accepted.

Table 6. Logistic Regression to Predict Usage of Smartphone in the Online Classroom

Subscale	Beta	S.E.	Sig.
Deep	-0.029	0.0276	0.2936
Strategic	-0.0017	0.024	0.9451
Surface	-0.0581	0.0352	0.0984
Constant	-0.0176	0.4727	0.9702

The conclusion that can be drawn from these results is that there was a difference in learning approaches between the participants in their use of smartphones to access their LMS. However, the difference was not related to those students who had used their smartphones to access the LMS as compared to those students who had not used their smartphones to access

the LMS. Instead, the difference in learning approaches was related to how often the students access the LMS with their smartphones. For those students who always access the LMS with their smartphones, there was a greater likelihood of utilizing both strategic and surface learning approaches as compared to the other students. However, there was no difference between students in the use of the deep learning approach based on the frequency with which they used smartphones to access the LMS.

By contrast, the two survey questions that formed the surface subscale are: “Much of what I’ve learned seems no more than lots of unrelated bits and pieces in my mind” and “I tend to take what is taught at face value without questioning it much” (items 20 and 21). These questions give credence to Tait et al.’s (1998) description of surface learning and suggest that the student's behavioral study habits may be the cause of the higher score on the surface learning subscale rather than the use of the smartphone being the causality of surface learning habits. Additionally, the finding that the effect on surface learning only occurs with the “always” frequency group suggests that some confounding variable not accounted for in the design of the study may mediate the frequency of smartphone use in the course and the outcome of higher levels of surface learning.

To draw out this latent factor of the “always” group (those who selected “always” to describe the frequency of using a smartphone to log in to their online classroom) and their correlation with higher levels of surface learning, an ANOVA of how often students indicated they used the smartphone to log in to the LMS was used as the factor, and the student’s university grade point average (GPA) was the dependent.

This ANOVA tested the null hypothesis that GPA (e.g., a measurement of student performance) is related to the frequency of smartphone use to log in to the LMS. The results of the ANOVA indicated that smartphone use frequency is not a significant factor to student GPA for either female or male survey respondents. These results indicate that low-performing students are not likely to be more susceptible to further smartphone use frequency, in terms of logging in to the LMS, as one might assume.

However, a noteworthy finding of the post-hoc t-tests of the ANOVA revealed a statistically significant difference in GPA for male survey respondents between the “never” and “always” groups of student respondents to the question of “how often do you use your smartphone to log in to your online classroom?” Tables 7 and 8 provide the ANOVA analysis results for student GPA based on how often participants used a smartphone to sign in to the online classroom.

Table 7: Student GPA and Smartphone Use Frequency

Subscale		Sum of Squares	df	Mean Square	F	Sig.
FEMALE	Between Groups	1.154	4	0.289	0.857	0.489
	Within Groups	394.438	1172	0.337		
	Total	395.592	1176			
MALE	Between Groups	1.770	4	0.443	1.409	0.231
	Within Groups	91.727	292	0.314		
	Total	93.497	296			

More specifically, the above results indicate that a low probability of Type II error exists, when the null hypothesis that there is no difference for female and male respondents in the interrelation between student GPA and smartphone use frequency is accepted, since the p value (0.489; 0.231) levels have been respectively found to be significantly higher than 0.05. By contrast, only for male students that have always used their mobile phones to access LMS have been found significant differences in their GPA levels as opposed to students that have never used their smartphones for LMS access, with a relatively low probability of Type I error, since the corresponding p value (0.026) has been found to be lower than 0.05.

Table 8: Post-Hoc ANOVA Results for Student GPA and Smartphone Use Frequency

Subscale			Mean Difference	S.E.	Sig.
MALE	Never	Very seldom	0.073	0.099	0.460
		Occasionally	0.035	0.097	0.718

	Frequently	0.109	0.087	0.211
	Always	.31231*	0.140	0.026
Very seldom	Never	-0.073	0.099	0.460
	Occasionally	-0.038	0.107	0.720
	Frequently	0.036	0.098	0.716
	Always	0.239	0.147	0.105
Occasionally	Never	-0.035	0.097	0.718
	Very seldom	0.038	0.107	0.720
	Frequently	0.074	0.096	0.441
	Always	0.277	0.146	0.058
Frequently	Never	-0.109	0.087	0.211
	Very seldom	-0.036	0.098	0.716
	Occasionally	-0.074	0.096	0.441
	Always	0.203	0.139	0.145
Always	Never	-.31231*	0.140	0.026
	Very seldom	-0.239	0.147	0.105
	Occasionally	-0.277	0.146	0.058
	Frequently	-0.203	0.139	0.145

The results of the study also show that the participants who always use smartphones to access the LMS for online courses have higher strategic learning subscale scores. The four survey questions that formed the strategic subscale are: “I manage to find conditions for studying that allow me to get on with my studying easily”; “I create a study schedule”; “I pay attention to what my instructors seem to think is important and concentrate on that”; and “I look carefully at instructors’ comments on my assignments to see how to get a higher score next time” (items 24, 25, 26 and 27).

An explanation for the findings can be drawn from items 24 and 25: students who always use their smartphones to access the online course may be able to (or self-perceive they

can) adapt to their environment more easily and convert their current environment into a study situation through their use and aptitude of the smartphone. Another explanation of the findings from items 26 and 27 might be that students who always use their smartphone to access the online course perceive that they are strategic in their learning habits, whether effective or not. From this perspective, the findings suggest the importance of the student characteristics for converting information into knowledge. As a result, the smartphone may merely provide a tool for the student to engage in behaviors that lead to strategic learning, even though focus group interview results also indicate that the usage of these and other mobile devices for learning purposes can also involve technological barriers and low learning effectiveness levels.

Therefore, one must consider that this effect was only significant for the group of students who indicated they always used their smartphone for signing in to the LMS.

4.2.4 Research Question 3

The third research question: Is there an engagement difference between students using a smartphone to access their LMS and students using a computer? To answer this question, four engagement subscale questions were used concerning skills, emotional engagement, participation/interaction, and performance. Table 9 shows the questions that were included in each subscale. A reliability analysis was performed during pilot testing and each of the subscales had a Cronbach's alpha of 0.70 or higher. Based on this information, the decision was made to include these questions in the subscales.

Table 9. Survey Items Included in Learning Engagement Subscales

Learning Engagement and Subscale Items
Skill Engagement
1.Make sure to study on a regular basis
2. Create study notes while reviewing course material
3.Frequently check for instructor comments and updates

Emotional Engagement

4.Find ways to make course material relevant to me

5.Applying course material to my life

6.Reflect on course content and topics even when I'm not actually logged into Class

7.Really desiring to learn the material

Participation/Interaction

8.I frequently ask my instructor about specifics related to feedback of my Assignments

9.I frequently exceed the minimum online discussion participation requirement

10. I enjoy interacting with other students in class

17. I typically only meet the minimum online discussion participation requirement

Performance Engagement

11.I desire to do well on tests and assignments

12.Earning a good grade is important to me

13.I regularly checked the progress of my course grade

14.I'm confident I can learn the course material

A factor analysis was also performed to determine whether these questions were appropriately related to each other. Any item with a factor loading of less than 0.40 was excluded. As is shown in Appendix 6, the KMO test showed a measure of sampling adequacy of 0.899. In addition, the results of Bartlett's test of sphericity showed that the null hypothesis that the correlation matrix between the items was an identity matrix could be rejected and the alternative hypothesis that the correlation matrix between the items was not an identity matrix could be accepted (Chi-Square = 10344.559, df=105, $p<0.001$). Given the low level of the p value (0.001), a low probability of Type I error, that of falsely rejecting the null hypothesis, exists. Based on these results, it was concluded that the subscales and the items in the subscales were appropriate.

To answer the third research question, an ANOVA was performed with the variable of "How often do you use your smartphone to sign in to your online classroom?" as the factor, and the subscale variables for skill, emotional engagement, participation/interaction, and performance as the dependent variables. The null hypothesis for the ANOVA is that there is no statistically significant difference in learning approaches of the students based on how often they use their smartphones to sign in to their online classes. The alternative hypothesis is that there is a statistically significant difference between the learning approaches based on how often they use their smartphones to sign in to their online classes.

Table 10 shows the results of the ANOVA. The only learning engagement subscale in which there was a significant difference based on how often the participants used their smartphones was the emotional engagement subscale, in relation to which Type I error was unlikely to be made, as the p value (0.02) for the emotional subscale was below 0.05. None of the other subscales were significantly different with regards to how often the participants used their smartphones to access the online classroom. Thus, as regards skills, participation and performance subscale, it is unlikely that Type II error was committed, as all respective p values (0.46; 0.23; 0.22) have been found to be significantly higher than 0.05. The ANOVA for learning engagement subscales is based on how often participants used smartphones to sign in to the online classroom.

Table 10. ANOVA Results for Learning Engagement Subscales

Subscale		Sum of Squares	df	Mean Square	F	Sig.
SKILLS	Between Groups	16.653	4	4.163	0.896	0.465
	Within Groups	7867.848	1694	4.645		
	Total	7884.5	1698			
EMOTIONAL	Between Groups	84.733	4	21.183	2.85	0.023
	Within Groups	12420.596	1671	7.433		
	Total	12505.329	1675			

Subscale		Sum of Squares	df	Mean Square	F	Sig.
PARTICIPATION	Between Groups	60.217	4	15.054	1.378	0.239
	Within Groups	18042.378	1652	10.922		
	Total	18102.595	1656			
PERFORMANCE	Between Groups	17.442	4	4.361	1.416	0.226
	Within Groups	5129.495	1666	3.079		
	Total	5146.937	1670			

Based on the results of the ANOVA, there are significant differences in the learning engagement of the participants in terms of how often they use their smartphones to sign in to their online classes. The significant differences are related to emotional learning engagement.

The question that arises is where the differences exist in terms of how often students actually sign in to their online classes on their smartphones. To answer this question, the post-hoc test of least significant difference (LSD) was performed. This test is a t-test in which differences between the means of each response category of the factor are compared, which in this case is how often the students indicated that they signed on to their online classes on their smartphones.

Table 11 shows the results of the LSD test for each of the response categories for the emotional engagement subscale variable. Any category with a significance of 0.05 or less indicates that the mean difference from the other response categories is statistically significant. The results show that for the emotional subscale, the only response category that was statistically significantly different from the others is the “always” category, as compared to the “never” category, which also indicates a low probability of Type I error for the combination of these categories, given its low p value (0.02). This means that a significant difference in emotional engagement existed between the students who indicated that they always used their smartphones to access the online classroom as compared to the students who indicated that

they never used their smartphones to access the online classroom. The differences in the mean scores indicate that the students who always accessed the online classroom with their smartphones had a higher level of emotional engagement than the students who never accessed the online classroom with their smartphones. Combinations of other categories have not been found to be significantly different with a highly low probability of Type II error, since the corresponding p values have been significantly higher than 0.05, while ranging from 0.517 to 1.000.

Table 11. Post-Hoc ANOVA Results for Engagement Subscales

Subscale			Mean Difference	S.E.	Sig.
EMOTIONAL	Never	Very seldom	-0.3205	0.2037	1.000
		Occasionally	-0.3245	0.1848	0.793
		Frequently	-0.117	0.1843	1.000
		Always	-0.945	0.3057	0.020
	Very seldom	Never	0.3205	0.2037	1.000
		Occasionally	-3.99E-03	0.2088	1.000
		Frequently	0.2035	0.2084	1.000
		Always	-0.6246	0.3208	0.517
	Occasionally	Never	0.3245	0.1848	0.793
		Very seldom	3.99E-03	0.2088	1.000
		Frequently	0.2075	0.19	1.000
		Always	-0.6206	0.3091	0.449
	Frequently	Never	0.117	0.1843	1.000
		Very seldom	-0.2035	0.2084	1.000
		Occasionally	-0.2075	0.19	1.000
		Always	-0.828	0.3088	0.074
	Always	Never	0.945	0.3057	0.020
		Very seldom	0.6246	0.3208	0.517
		Occasionally	0.6206	0.3091	0.449

	Frequently	0.828	0.3088	0.074

Another way in which to examine the research question of whether there is a difference in learning engagement among the students who use smartphones to access the online classroom is to perform a logistic regression using the data from the question of "have you used your smartphone to sign in to your online classroom?" as the dependent variable. This question allows for the complete separation of students who used their smartphones to sign in to the online classroom in any way as compared to those students who did not use their smartphones to sign in to their online classroom. Logistic regression was required because the dependent variable is a dichotomous variable, meaning it only has two response choices, either “yes” or “no.” The independent variables for the logistic regression were the variables created for the subscales of skills, emotional engagement, participation/interaction, and performance.

Table 12 shows the results of the logistic regression analysis. The null hypothesis for the regression is that the independent variables were not significant predictors of the dependent variable. The alternative hypothesis is that the independent variables were significant predictors of the dependent variable. Any independent variable with a p-value of less than 0.05 was determined to be a significant predictor of the dependent variable.

Table 12.Logistic Regression Results of Independent Variables Regressed

Subscale	Beta	S.E.	Sig.
Skills	0.073	0.035	0.040
Emotional	-0.109	0.028	0.000
Participation/Interaction	0.027	0.020	0.164
Performance	0.028	0.036	0.439
Constant	-0.603	0.592	0.308

Unlike the results with the ANOVA, the results of the logistic regression showed that both the skills and emotional engagement variables were significant predictors of whether the participants had ever used their smartphones to sign in to the online classroom. For this reason,

for the variables skills and emotional, the null could be rejected with a low probability of Type I error, due to low levels of p values (0.040; 0.000) respectively. Conversely, for the variables participation/interaction and performance, the null hypothesis was accepted with a low probability of Type II error, given the significantly high p values (0.164; 0.439) respectively.

The positive beta coefficient from the logistic regression for the skill variable shows that the students who indicated that they had accessed the online classroom with their smartphones had higher scores on the skills engagement variable than the students who had not accessed their online classroom via their smartphones. However, the negative beta coefficient for the emotional variable indicates that the students who accessed the online classroom from their smartphones had lower emotional learning engagement scores.

Therefore, in relation to the third research question, the present study indicates that a consistent, but situation-dependent difference, such as among those who always use their mobile phones to access LMS, between students using a smartphone and those making use of a computer in relation to the emotional subscale of engagement exists. Nevertheless, the logistic regression results also suggest that the skills subscale of engagement is also positively interrelated with the tendency to use one's smartphone to access LMS, whereas the emotional subscale was found to have a negative loading on the latter dependent variable.

4.2.5 Quantitative Data Summary

Overall, the results of the statistical analysis in relation to whether there is a difference in engagement based on whether participants accessed their online classroom using their smartphones are somewhat conflicting. The results of the ANOVA showed that there is a significant difference between students who always and never access the online classroom on their smartphones. Regarding emotional learning engagement, students who always accessed the online classroom with their smartphones had statistically higher emotional learning engagement.

The results of the logistic regression analysis showed the same significant relationship involving the emotional learning engagement variable. However, the logistic regression also showed that the skills variable was a significant predictor of whether students always or never used their smartphones to access the online classroom. For the skills variable, the students who never used their smartphones to access the online classroom had higher skills learning engagement than students who always used their smartphones to access the online classroom.

4.3 Qualitative Analysis

The qualitative data was obtained from two focus groups examining the types of tasks students were attempting to accomplish when they access their LMS via smartphone and the reasons they use the smartphone to access the LMS. The participants in both focus groups were undergraduate students indicating that they used their smartphone to access the online LMS classroom.

Because the participants in the focus groups were all students who have used smartphones for some type of LMS access, the responses reflect the perceptions of the utility of smartphones in the online classroom among students with experience using the device. Table 13 provides the gender and age range for the participants in the two focus groups.

Table 13. Gender and Age of Focus Group Participants

Focus Group	Number	Female	Male	Age
Focus Group 1	15	9	6	18-39
Focus Group 2	12	7	5	23-46

The analysis of the data relied on a comparative analysis of focus-group interviews, which is an iterative process involving multiple examinations of the data, while seeing to identify main themes in the responses of interviewees (Cargan, 2007). The qualitative analysis is intended to capture the commonalities of the perceptions and understandings of subjects that

provide data in a narrative form (Lapan, Quartaroli, & Riemer, 2011). The first phase involves open coding that decomposes the data provided by the focus group participants to identify the major themes, which function as coding labels (Punch, 2014).

The open coding has a relatively high level of abstraction intended to incorporate all of the perceptions and actions associated with the theme (Yin, 2016). The criterion used for identifying a theme was direct or indirect mention of a concept by at least half of the participants in the focus groups. According to Ryan and Bernard (2003), the number of repetitions in the data necessary to support the existence of a theme is not an objective decision and varies among researchers. Discussion by half of the focus group participants was selected as a threshold for identifying a theme to ensure that analysis included the important themes without excessive consideration of outlier information that was of concern to only a few of the participants.

The axial coding followed the open coding. The axial coding involved recombining or reconstructing the data around the themes to identify the patterns associated with a theme (Flick, 2006). The patterns allowed for some degree of variation among the elements of the theme that the focus group participants perceived as significant. The criterion used for identifying a pattern within a theme was mentioned by at least four participants in the focus groups—about 25% (n=4) of the participants. The criterion was established to support variation without presenting an excessive number of patterns within each theme. As recommended by Morgan (1997) and Humble and Green (2016), the unit of analysis at both the open-coding and axial-coding levels was the individual rather than the group to avoid the need to infer meaning to the group based on the statements of individuals. Consequently, the presentation of the results of the analysis of the focus group data examines the viewpoints and comments of the individual participants rather than consolidating the data to reflect the focus group (Hennick, 2013).

The analysis of the data identified the four themes of convenience, passive use of smartphones, generating content with smartphones and shortcomings in the use of the smartphone with the LMS. The analysis also identified patterns associated with the major

themes. Table 14 shows a summary of the themes and patterns resulting from the analysis. The table also shows the total counts of the number of times the participants provided comments related to the theme and the number of times the participants provided comments useful for identifying a pattern within the theme.

Table 14. Count of Data Related to Themes and Patterns

Theme	Count	Pattern	Count
Convenience	28	Use away from home	12
		Resolve specific problem with LMS access	4
		Time management	7
		Frequency	5
Passive Uses	31	Gathering course information	31
		Read material	13
Generating Content	19	Posting to discussion questions	15
		Completing assignments	4
Shortcomings	25	Does not support submissions with Word	4
		Size of screen	4
		Technical issues	5
		Needs adaptations	4
		Recommendations	6

The third phase of the coding involved developing a narrative useful for the research purpose based on the themes identified from deconstructing the data and the patterns from reconstructing the data (Creswell, 2014). The data from the narrative was used to answer the fourth and fifth research questions of the study that depend on a qualitative perspective. In the presentation of the findings of the analysis, the statements made by the focus group participants have been used to substantiate the findings of the present research (Saldana,

2015). In addition, answering each of the research questions required data from several of the major themes and patterns.

4.3.1 Research Question 4

Research question 4 asked: What are the specific tasks online students are trying to accomplish when accessing their LMS via smartphone? The information to answer the research question is primarily found in the themes concerning passive use and generating content. There are, however, additional patterns contained in the other themes that have a relationship to the specific tasks that the students are attempting to accomplish when they access their LMS with the smartphone.

The analysis of the data suggests that the acquisition of information from the LMS was a crucial task for which students use their smartphones, which involves the theme of the passive use of the smartphone. The students in the focus groups perceived that the LMS contained a substantial amount of information that is useful and necessary for participation in the class that should be accessed frequently with the smartphone as a viable tool for access. The two themes of gathering course information and reading course material are the primary passive tasks for which the students use the smartphones.

The pattern of gathering course information reflects a major use of the smartphone by the students in the focus groups. The students use the smartphone to stay in touch with the class. Fifteen of the participants specifically mentioned the use of the smartphone to *"check on grades."* The task involves self-monitoring of performance to determine if some type of remedial action is necessary. In addition, the word "*check*" was used with other tasks such as examining the LMS for announcements, new posts, and the "*status of assignments*." Several of the participants also mentioned that they used the smartphone to "*look up information for class*" or find out about "*due dates or to check the syllabus*." The pattern suggests that the students view the smartphone as an important information-gathering tool necessary for participation in an online class.

In general, the participants in the focus group suggested that the smartphone is the primary means for accessing information from the LMS when they were not at home or could not

access tablet or laptop computer. The students recognized that the LMS is the conduit by which the instructor shares information with the class, including grades. Consequently, students believe that they must frequently visit the LMS to obtain information, with the task of visiting the LMS taking on substantial importance.

The second pattern in the theme of the passive use of the smartphone involves reading course material based on the analysis concerning the perceived value of the smartphone for reading the material provided at the LMS. Some of the students were very positive about the use of the smartphone for the task of reading material online. The specific tasks noted by the students who were positive about the smartphone included reading *"the DQs and student response,"* "*notes . . . and assignments*," and "*read my e-book*." The results suggest that many of the students in the focus groups used the smartphone as a major method for accessing and reading course material.

One of the participants with reservations about the utility of the smartphone for online reading indicated that there was a need to download much of the material to reading devices such as Kindle. In the theme of shortcomings, other participants suggested that they needed *"reading glasses because of the small print"* on the smartphone. Another participant had a study style that was incompatible with smartphone use for reading the course material. This participant stated, *"I need to keep review material in front of me, and that isn't easy to do with a phone."* The participant indicated that the difficulty was in moving back and forth in the reading when necessary to support better understanding. Consequently, the research determined that some students do not extensively use the smartphone to access the readings and other study information because they cannot make effective use of the information from the smartphone platform.

The findings concerning the passive use of the smartphone for reading course material implies that it is a study tool for many of the students who can read the material and are comfortable with the format. Rather than downloading the e-books and other readings associated with the course, they read the material in the LMS. Furthermore, many of the students participating in the focus group questioned the effectiveness of the smartphone for reading and studying

material at the LMS site based on their physical abilities and their individual learning styles. As a result, there may be significant variability among students in the use of the smartphone for tasks associated with reading.

The second major theme related to the type of tasks involves generating content for posting in the LMS. The two patterns within the theme of generating content are the use of the smartphone to compose and post responses to discussion questions and to submit written assignments. In general, the participants in the focus groups indicated that they used the smartphone to generate content rather than for passively acquiring information about the class.

In the pattern of posting discussion questions, 14 of the focus group participants mentioned that they used the smartphone for this task when they had the opportunity to comment on postings. The use of a smartphone for the task of posting to the discussion forums, however, may depend on the skill of the student with the smartphone. As with the data concerning the use of the smartphone for reading, many of the students did not feel comfortable using the smartphone to compose responses to the posts. When discussing the shortcomings of the smartphone one student mentioned: *"the website is not supported on a smartphone so I cannot post from it.*" The student may have meant that the smartphone could not access the LMS. An additional use of the smartphone that to some degree involved generating content was its use for the task of contacting the instructor. One participant in the focus group stated the smartphone was useful to "*write my individual questions to the instructor*." There were only two of the participants indicating that they used the smartphone for the task of direct communications with the instructor.

The second pattern in the theme of generating contact was that the smartphone could not be used to perform all the tasks necessary to complete assignments. The participants in the focus groups suggested that they could not complete lengthy assignments that had to be submitted in Word by using the smartphone. One participant, however, suggested that the smartphone could be helpful for partially completing assignments by stating "*I write the paper in my notes on the phone then transfer the notes to my laptop*." Another participant indicated

that the smartphone was helpful for "*taking notes*" that could be used later to prepare a written assignment on a laptop or other device to be submitted in Word.

The analysis of the data indicates that students perform both passive and active tasks associated with the class and the LMS, but the type and scope of the tasks varies because of factors such as the type of smartphone and individual abilities. The most common tasks were obtaining information from the LMS about grades, postings, and deadlines and generating discussion posts that can be entered directly from the smartphone. To some degree, many of the students indirectly suggested that the development of a specific app for the smartphone would be beneficial for improving their ability to perform many tasks using the smartphone. In the theme of shortcomings, five participants stated that a smartphone app would help them to use the device with the LMS. One student noted that "*a browser or platform that let me log on or even an app that worked well*" would be helpful while another student said that an "*app for the classroom would make things much easier*." Some of the participants were less optimistic about the ability of an app to resolve all the problems associated with using the smartphone to perform more complex tasks such as writing lengthy assignments. The issues limiting the use of the smartphone despite the possibility of developing an app to increase LMS accessibility involved some of the difficulties with using the smartphone because of the size of the screen and with accessing reference material or readings while composing.

4.3.2 Research Question 5

Research question 5 asked: What are the underlying themes as to why students access their LMS via smartphone? The information to answer the question is found primarily in the theme and patterns concerning convenience. Some of the information from the other themes of passive uses, shortcomings, and generating content provide additional insights useful for determining the reasons that the participants in the focus groups access their LMS with smartphones.

Almost all the students directly mentioned that convenience was the main reason that they used the smartphone to access the LMS. The most significant aspect of convenience was the ability of the smartphone to allow students to remain connected to the LMS when the students were away from their homes or their usual study areas. The discussion among the participants in the focus group included statements such as using the smartphone *"when I am out and want to post*" and to "*log on to do assignments when I'm not at my house*." The use of the smartphone when away from home was also related to the desire to perform certain tasks based on the availability of time to study or the need to meet a deadline. One participant used the smartphone for studying when away from home, stating that the smartphone allowed him to "*access textbooks when away from my computer*." The general perception among the focus group participants was that the smartphone increased the number of class participation opportunities that they could take advantage of during the day. The convenience of using the smartphone when away from home, however, was not the only reason for using the device discussed by the focus group participants.

Some of the students used their smartphone when there was a problem with using the computer that they normally used to access the LMS. One participant indicated that it was difficult to use a computer around her children, but she could do at least some of the homework using the smartphone when the children were present. Another student used the smartphone "*when dangerously close to meeting a DQ deadline*" when they were away from home.

The statement implies that the student posted a discussion question from the smartphone. In effect, the reason for using the smartphone was to accomplish a task on time that would not have been possible if the student had wanted to use a computer. Another type of problem that the smartphone could resolve was a technical issue with a laptop computer that interfered with the ability to log in at the LMS. The smartphone allowed the student to remain connected with the class despite the technical issue. Another student noted that she had been "*in the hospital and [was] only able to post from a smartphone*." The analysis of the data suggests that many of the participants relied on using the smartphone as a backup system for their regular means of accessing the LMS, which increased their ability to participate in online classes.

Another pattern revealing the purpose of the participants for using the smartphone was time management. In general, the participants indicated that the smartphone allowed them to study and to perform tasks necessary for the online class during relatively short periods of time throughout the day. As a result, they could spend more time studying or posting. Comments about time management included "*read . . . during lunch breaks or slow times at work*" and doing class work when there is "*down time on my commute to work, breaks, and lunch time*." One participant said that using the smartphone results in "*better use of time when waiting in line or sitting idle*." The participants in the focus group perceived that the quality of the learning that occurred from accessing the LMS briefly one or more times during the day was like the quality of learning from engaging with the LMS for longer periods of time. The perception that the quality of learning is adequate is reflected by a comment concerning the type of tasks from a participant: *"I typically enter responses in the DQ forum, occasionally do initial DQ posts and, when necessary contact the instructor. I also check grades, professor's responses, and look up information for the class*." In effect, the smartphone is perceived as having the ability to provide a platform for partial engagement with the LMS depending on the type of task.

Only five of the focus group participants directly mentioned the frequency of use of the smartphone for accessing the LMS. The responses suggest that some students rely on the smartphone for accessing the LMS *"almost daily*" while other students use the smartphone to access the LMS only occasionally.

Many of the comments of the participants, however, implicitly suggested that they use the smartphone frequently for accessing the LMS. The students that use the smartphone when away from home are likely to access the LMS relatively frequently. The general findings suggest that the frequency of use is somewhat related to the perception that the smartphone increases convenience. The focus group participants who were routinely away from home during the day used the smartphone more frequently to remain engaged with the class.

The themes other than convenience suggest that students access the LMS with the smartphone to obtain information and to post to discussion question forums. These are necessary tasks and when they need to perform the tasks away from home and during periods when they have available time were perceived as a significant benefit of using the smartphone. Some of the participants in the focus groups who were more technically proficient developed adaptations for the smartphone to increase its usefulness for accessing the LMS when away from home or their usual computer. The pattern associated with needs adaptation indicates that one student used a "*Microsoft Wedge keyboard*" to improve usability with a smartphone that has Bluetooth connectivity. Another participant made sure that the smartphone used for the course "*works quite well with LoudCloud*," which is the cloud host function for the LMS. The implication of the analysis of the data is that not all the smartphones interface well with the LMS for technical reasons.

Furthermore, some of the participants in the focus group suggested that the technology barriers limited the possible uses of the smartphone, which influenced the reasons that the participants accessed the LMS with the smartphone. One participant stated, "*Reading e-books and checking grades are really the only two things I can do from my phone*," which limits the possible reasons that a student would use the smartphone. Similarly, the students noting difficulties reading material because of the size of the screen would also have fewer reasons to access the LMS via smartphone.

The analysis of the data related to the fifth research question of the study suggests that the main reasons that students use the smartphone to access the LMS are maintaining contact with the class when away from home, improving time management, and to resolve a problem with their usual method of accessing the LMS. However, many of the participants in the focus group noted substantial barriers to the use of the smartphone that reduced its convenience. The barriers were more significant for performing tasks than for accessing the website in general. Nonetheless, the barriers influenced the decisions of many of the participants in the focus group as to the convenience of the smartphone for accessing the LMS.

4.3.3 Triangulation of Findings

The key triangulation conclusion of this study is that the possession of a smartphone represents a prevalent precondition for m-learning, but does not necessarily lead to using mobile devices to engage in learning-related practices, such as accessing LMS. This has been supported by the findings that the most significance learning approach is surface learning, which does not involve deep learning activities, such as making efforts to gain an in-depth understanding of course materials. Furthermore, another significant learning approach is strategic learning which is primarily supportive of other learning activities, such as schedule management and comment review. First, the LSD findings show that to a large extent surface and strategic learning approaches primarily occur during mobile learning when the frequency of smartphone use is very high. Second, as the regression results demonstrate, that on their own students learning approaches do not seem to have an influence on the frequency of smartphone use.

In other words, it is high levels of students' engagement with their smartphones that are likely leading to the presence of surface and strategic learning approaches. However, one must not assume that the smartphone is causal to surface learning. Students more prone to surface learning behaviors may simply be more prone to higher frequency of smartphone use via the LMS. This is supported by the findings concerning student engagement that show that only its emotional aspect is statistically significantly interrelated with the frequency of smartphone use.

The results of the post-hoc ANOVA analyses, likewise, also suggest that a highly frequent use of smartphones is significantly interrelated with emotional engagement.

The regression analyses' results also indicate that emotional engagement and smartphone use frequency are likely to be reciprocally related.

These quantitative findings are corroborated by qualitative analysis results that show that passive uses of smartphones, such as primarily for information gathering, are the most frequently mentioned ones, which corresponds to strategic learning. Another important dimension of smartphone use comprises aspects related to surface learning, such as material reading and discussion forum posting, which is apparently interrelated with the convenience of using these mobile devices away from home. Additionally, qualitative findings suggest that limited student engagement in the context of m-learning may be due to the technical difficulties that students encounter with using smartphones for accessing LMS and completing learning tasks within these environments.

The present findings extend the argument of Mackay and Burt (2015) in that they indicate that surface and strategic learning are the most prevalent approaches to learning when students undertake m-learning activities using smartphones. In other words, this study contributes to scholarly literature, such as the study of Mackay and Burt (2015), by indicating that designers of LMS need to take into account not only the strategic learning approaches governed by means-ends rationality, but also surface learning activities. Moreover, this research indicates that strategic learning can be expected to be supportive of surface learning, due to the characteristics of mobile devices used and the non-classroom contexts of mobile learning, which can, for example, preclude an effective utilization of word processing software. This can also introduce limitations to the utility of LMS on mobile devices that are strongly associated with emotional engagement in the context of m-learning as well. Additionally, this study qualifies the study of Dron and Anderson (2014) in that it suggests that mobile learning and student engagement are interrelated to a limited extent only. This is a significant finding, since this is an empirical study that has explored the qualitative and quantitative interrelations between the key variables that underpin mobile learning.

This goes beyond the general conclusions to which theoretical studies, such as those of Mackay and Burt (2015) and Dron and Anderson (2014), tend to arrive. Furthermore, this study tentatively supports earlier findings indicating that the frequent use of mobile devices can have a positive impact on student engagement during mobile learning (Kim, Mims, & Holmes, 2006; Skiba, 2008; Reychav & Wu, 2015). More specifically, this study fills a gap in scholarly literature, as it has inquired into which specific learning approaches, student engagement dimensions and learning practices predominate among university students in the context of mobile device use. This goes beyond previous studies, such as that of Kim, Mims, and Holmes (2006) that has primarily concentrated on the technical aspects of m-learning solution implementation, such as wireless technology infrastructures that are best suited for mobile learning based on their flexibility, associated costs and scalability. Likewise, this study follows the suggestion of Skiba (2008) that it is necessary to conduct empirical studies that inquire into the student evaluations of mobile learning solutions. Therefore, the empirical knowledge that this study has produced makes a valuable contribution to the pedagogical knowledge on learning approaches, engagement-related factors and learning practices that using smartphones for the purposes of mobile learning involves.

Likewise, the present study goes beyond the research of Reychav and Wu (2015) in that it indicates that surface learning and strategic learning are significantly interrelated in m-learning contexts among university students, whereas the educational intervention study of Reychav and Wu (2015) primarily concentrates on cognitive dimensions of deep learning in relation to mobile technology, as part of multimedia training among over 500 iPad and iPhone users ranging in their age from 16 to 65 years. In other words, the present study demonstrates that m-learning is a multi-dimensional phenomenon that involves not only deep learning, as Reychav and Wu (2015) argue, but also surface and strategic learning as complexly structured dimensions of student learning in the context of mobile technology.

4.4 Summary

The analysis of the quantitative data from the survey questionnaire showed that 93.5% (n=1,712) of the respondents owned a smartphone. However, only 62.3% (n=1,067) of the respondents use a smartphone for studying, while 68.6% (n=1,172) use a smartphone to log in to online classes. Slightly less than half of the respondents (45.1%, n=771) indicated that they never or very seldom used their smartphone for online coursework. ANOVA was used to determine whether statistically significant differences existed in student learning approaches based on the frequency of use of smartphones to sign in to online classes. The analysis showed that a statistically significant difference existed only for the learning approaches of strategic and surface learning among students grouped in accordance with how frequently they use smartphones to sign in to their online classes. Further analysis using a post-hoc t-test showed that respondents who always use their smartphones to sign in to online classes have higher scores in surface and strategic learning. In contrast, a logistic regression analysis of the data showed that the use of the smartphone to sign in to online classes was not a predictor of learning approaches employed by online students. The analysis of the data with ANOVA also showed that the groups based on the use of the smartphone had a statistically significant difference only in the subscale of emotional engagement. Further analysis with a post-hoc t-test showed that students who always used their smartphones to sign in to online courses had a higher level of emotional engagement than students who never used their smartphones to log in to online courses. A logistic regression analysis of the data indicated that both the skills and emotional engagement variables were significant predictors of whether the participants had ever used their smartphones to sign in to the online classroom.

The analysis of the qualitative data obtained in the focus groups identified four engagement themes of convenience, passive use of smartphones, generating content with smartphones, and shortcomings in the use of the smartphone with the LMS. The themes and the patterns within the themes further identified the specific tasks for which the students used the smartphones. The most common task was to remain in touch with the class and to passively obtain information about the class.

Students also used the smartphones to read course material, but many of the participants in the focus group were not comfortable reading course material on the smartphone format. Some of the students also used the smartphone for generating content such as posting to forums. The students, however, could not generate content in Word for online submissions because of the smartphone format and the inability of apps available to upload content to the LMS. The reason that most of the focus group participants noted for using the smartphone to access online courses was convenience when away from home. Some of the participants also considered the smartphone a helpful alternative when it was not feasible to use a computer. The analysis also showed that students tend to make adaptations in how they use the smartphone based on their specific needs. In general, the participants faced fewer barriers to accessing the LMS with the smartphone than in performing necessary tasks for learning such as downloading reading material or uploading assignments.

CHAPTER 5 DISCUSSION

5.1 Introduction

The present research examined the differences in LMS usage among various student groups, the interrelations between the smartphone use level and learning approaches and student engagement and the patterns of and reasons for the usage of smartphones for accessing online courses and learning materials. The obtained results are likely to be representative of students enrolled in online education programs at North American universities, since the empirical data collected from students using a survey questionnaire and focus groups have demonstrated validity and coherence. This chapter discusses the findings and presents conclusions related to the research questions of the study. The chapter contains a summary of the study, followed by an in-depth discussion of the findings as related to each research question. The chapter also brings the literature review to bear on the results of this research.

5.2 Discussion Related to Research Questions

The following subsections discuss the findings and are structured around the research questions of the study. Each subsection relates the findings to the literature and provides an interpretation of the findings. The subsections also consider the reasons for anomalous or unexpected findings.

5.2.1 Discussion of Research Question 1

The first research question of the study was RQ_1: *To what extent do online students access their LMS using a smartphone?* The results support the conclusion that approximately two-thirds of the students (n=938, 54.90%) in online courses actively use their smartphone for logging into the LMS and for studying. Almost all the students participating in the study owned a smartphone, which indicates that approximately one-third of the students do not use the smartphone to support online learning activities.

The descriptive analysis of the quantitative data showed that most participants used a smartphone for logging into online classes (n=1172, 68.6%) and for studying (n=1067, 62.3%). Despite the relatively high percentage of participants that use the smartphone for online classroom access, the results also indicate that almost one-third of the students (n=536, 31.4%) who own smartphones do not use the device for accessing the LMS in their online courses.

The data related to the first research question also assessed the frequency of using smartphones to log in to the LMS for online classes. The analysis of the data showed that 30.4% (n=519) of the respondents to the survey always or frequently used their smartphones to log in to online classes. These results corroborate Hernández and Pérez's (2014) finding that 19.54% (n=1,428, for the 2012/2013 academic year) of their student study population accessed their LMS via a mobile device. The increase to 19.54% (n=1,428, for the 2012/2013 academic year) of online students visiting their LMS via mobile device, such as smartphones, in the Hernández and & Pérez's (2014) study, from the 1.42% (n=104) of online students visiting their LMS via smartphone in the academic year 2009/2010 found in this study may be attributed to the increasing predominance of the smartphone as the primary type of mobile device that students researched in this study possess. Thus, of the LMS use data for a sample of 460 students out of 7,310 those enrolled in their studies at the Technical University of Cartagena, Spain, that Hernández and & Pérez (2014) have investigated in relation to m-learning during 2012/2013 academic year, 91.0% (n=374) have been found to have smartphones, even though only 79.9% (n=299) out of these respondents have been found to engage in m-learning.

However, the findings of Hernández and Pérez (2014) need to be qualified, since not all university-wide online information systems incorporate m-learning elements, also since these researchers have indicated that university LMS use varies significantly both based on the type of device used, e.g., desktop computers or laptops, mobile devices or tablets, the period of the academic year and the time of day. Furthermore, in the sample Hernández and Pérez (2014) have used to explore interrelations between m-learning and demographic variables, male students are overrepresented (70.4%, n=324), which limits the generalizability of their findings to the student population. Additionally, Hernández and Pérez's (2014) research aggregated smartphones into a conglomerated group of mobile devices and student data were pulled from

the LMS database via Google Analytics, whereas this current research thesis isolated smartphones into a separate category and data were derived from a student survey.

The percentage of students who do not use the smartphone for online courses gives credence to the argument of Blackburn and Stroud (2015) concerning the importance of technological interfaces to foster the use of the smartphone. Some students may not feel comfortable using smartphones to access course material based on the current level of technology within their LMS. It is also possible that many of the students did not use the smartphone for studying because of factors such as the size of the screen or personal learning styles that result in difficulty studying with the smartphone format. The population of students in this research was not privy to a smartphone-friendly LMS app. Therefore, all access to the LMS regardless of device was performed through a web browser. The fact that many students in this study (nearly one-third (27.7%; n=473) of the population claiming to have never used their smartphone to access the LMS) do not use the smartphone to access the LMS may also reflect the perception of the students of the difficulty associated with using the smartphone for online learning tasks or difficulty associated with the smartphone web browser not functioning well with the LMS. The perception of the difficulty of using the smartphone may stem from the specific technology used in the LMS that does not effectively support the smartphone (Wang et al., 2013).

The conclusion that can be drawn from the results related to the first research question is that almost all students in online courses, within this study population, have access to smartphones (93.5%; n=1,712), but only some students use the technology regularly as part of the online learning experience; (30.4% (n=519) responded as frequently or always using their smartphone to log in to their online class). Nevertheless, since most students have been found to be using their smartphones for accessing online courses and LMS interfaces, these findings suggest that the perceived utility and attitude toward the use of smartphones for online learning may vary significantly between different student groups. As the present discussion of scholarly literature suggests, this is also likely to apply to the interrelations between the research variables that this study has explored.

The following research questions contribute to an understanding of the factors leading to differences in the use of the smartphone in online courses.

5.2.2 Discussion of Research Question 2

The second research question of the study was RQ_2: *Is there an approach to learning difference between online students using a smartphone to access their LMS and online students who use another access medium?*

The analysis considered the three approaches to deep, surface, and strategic learning as the independent variables with the frequency of use of the smartphone to sign in to the online classroom as the dependent variable for purposes of sorting the respondents into groups to assess differences. The analysis determined that a statistically significant difference between groups existed for surface and strategic learning, but not for deep learning. The analysis of the data using an LSD post-hoc test also showed that differences existed between students who always use their smartphones to log in to the online course for surface and strategic learning. From this perspective, the smartphone may function as an aid to memory if it is used in supplement with other access mediums for LMS and course content. It is possible that the smartphone has the effect of supporting the frequent reinforcement of content material, which tends to improve the recall of facts. Additionally, the use of the smartphone may act as a first stage potentially leading to opportunities for strategic and surface learning in other contexts, especially as the frequency of smartphone use for accessing LMS increases.

The present empirical findings indicate that the frequency of smartphone use does not significantly affect students' academic aptitude, as measures by their GPAs. However, it was also found that for male students a significant difference in GPA score levels exists, in particular, for those who always use their smartphones to access course materials as opposed to those that never use their mobile phones for that purpose. Moreover, in this study it was found that smartphone use frequency is significantly associated with the strategic subscale of learning approach.

The present research

results also indicate that the constant use of the smartphone to access the LMS does not contribute to higher levels of deep learning among students in online courses when compared to the use of the smartphone for either frequent or occasional access to the LMS. Prior research has not investigated the relationship between mobile technology and deep learning. Deep learning involves the efforts of the students to connect the information learned in class to larger ideas (Biggs, 1987). Consequently, deep learning involves some degree of critical thinking as delineated in Bloom's taxonomy (Forehand, 2010). The use of mobile technology as the primary means of accessing the LMS should not have a different effect on deep learning than on surface or strategic learning; unless the explanation is the behavior and type of student who is more susceptible to using a smartphone for LMS access and not solely the medium with which one accesses the LMS, further research into mobile learning via LMS is necessary. Additionally, these findings also relate to the suggestion of Kashi (2016) that, rather than being a passive activity, learning is mutually constituted by self-directed practices, such as using smartphones to access LMS, the cognitive experiences that learners gain via their mobile devices and their social interactions with other learners and instructors in LMS environments.

Although there were no differences among the groups that have never, very seldom, occasionally, and frequently used smartphones to access online content, a significant interrelation between the group of respondents that always made use of smartphones and higher scores on surface and strategic learning was found. This partially supports the argument of Kashi (2016) that the social, cognitive and radical constructivism dimensions of learning are interrelated.

Nevertheless, the present findings also suggest that the rate of smartphone use is not likely to affect the levels of deep learning and academic aptitude that students exhibit. By contrast, this research indicates that, particularly among students that use their smartphones very frequently, smartphone use for LMS access can be expected to lead to differences in the strategic and surface aspects of their learning approach. Yet given that this is a panel study, it is

not possible to determine whether the learning approach differences also affect smartphone use levels that individual students exhibit. Those with higher levels of surface and strategic learning approaches subscales may be more inclined to use the smartphone as an LMS access tool, which demands additional research into the interrelations between these variables.

This is supported by the focus group findings which indicate that smartphones are primarily perceived as tools for accessing course materials and participation tasks, even though these devices have not been perceived by all research participants as effective learning tools, especially as far as reading course books is concerned.

5.2.3 Discussion of Research Question 3

The third research question of the study was RQ_3: *Is there an engagement difference between students using a smartphone to access their LMS and online students who use another access medium?* The findings of the study support the conclusion that students in online courses who use smartphones to access the LMS have greater emotional engagement with the course and the online learning experience. Additionally, the skills and emotional scales in the survey instrument were found to be predictors of whether students used a smartphone to sign in to the LMS.

The structure of the questionnaire fundamentally tested the proposition of Handelsman et al. (2005) that engagement consists of the four constructs of skills, emotional, participation, and performance engagement. The respondents in the study were grouped based on their frequency of use of the smartphone, which was the same procedure as used with the second research question of the study concerning learning approaches. The analysis showed that there were no statistically significant differences among the groups in the subscales concerning skills, participation/interaction and performance engagement. The findings, however, determined the existence of a statistically significant difference among the groups in the subscale of emotional engagement.

The LSD assessment of the emotional engagement data indicated that a statistically significant difference existed in the dimension only between the group that never used the smartphone to access the LMS and the group that always used the smartphone to do so, which

indicates that emotional engagement is significantly associated with smartphone use behavior. The logistic regression analysis of the data, however, found a negative correlation between use of the smartphone and emotional engagement as well as a positive correlation between use of the smartphone and skills engagement, which supports the previous findings.

The finding that frequent use of the smartphone is negatively associated with emotional engagement may reflect the personal characteristics of the individual student. The four survey questions that constitute the emotional engagement subscale are: “I find ways to make course material relevant to me”; “applying course material to my life”; “reflect on course content and topics even when I’m not actually logged in to class”; and “really desiring to learn the material” (items 4, 5, 6 and 7). Emotional engagement corresponds to the desire to truly learn the material and to apply the learning to their lives (Handelsman et al., 2005). The explanation, however, does not consider why a student would prefer to use a smartphone at times when access to the LMS with a larger screen computer is possible. The assumption was made when the study began that the smartphone would merely provide access to the LMS when away from computers or other types of mobile devices such as laptops. Instead, it is possible that smartphone use is simply a preferred mode of utilization for some portion of students. If the students prefer to use the smartphone rather than the desktop, there may be a few confounding variables not addressed in this study. Similar conclusions can be derived from focus group interviews, which indicate that either when away from their laptop or desktop computers or when students experience technical or other difficulties with computer use, smartphones have frequently enabled research participants to login into the LMS, complete their assignments on time and take part in learning-related activities.

The present finding of a positive correlation between skills engagement and smartphone use also suggests that those with lower smartphone use skill levels may have difficulties, while accessing LMS online for the purposes of m-learning. This can also have implications for the overall engagement levels of mobile learners. The three survey questions that form the skills engagement subscale were: I “make sure to study on a regular basis”; “create study notes while reviewing course material”; and “frequently check for instructor comments and updates” (items 1, 2 and 3). Skills engagement involves study habits and organizational practices

(Handelsman et al., 2005). Based on the present review of scholarly literature, the use of the smartphone can be expected to be associated with higher scores in the skill engagement dimension. The finding concerning the skills subscale, thus, may be understandable based on the multi-dimensional definition of engagement offered by Krause and Coates (2008), such as in relation to online learning, self-managed study, peer relations, student-staff interactions. Without the use of the smartphone, the student may need to make a greater scheduling commitment and spend more time with study and organization of the personal learning process. However, this research did not intend to review the existing study habits and demographics of students with higher engagement scores. Therefore, we cannot conclude that the smartphone is causal to a positive correlation between the skill engagement and use of the smartphone, which indicates a need for further research on the relations between smartphone use and various dimensions of student engagement.

The conclusion is that students who use their smartphone frequently for logging in to their LMS tend to have higher self-perception of their skills engagement. Focus group findings, likewise, indicate that the LMS may presuppose a high level of computer technology skills which can reduce the mobile learning engagement of students.

5.2.4 Discussion of Research Question 4

The fourth research question of the study was RQ_4: *What are the specific tasks online students are trying to accomplish when accessing their LMS via smartphone?* The findings support the conclusion that the specific tasks that online students are trying to accomplish when accessing the LMS with smartphones are acquiring information about the course and generating content for posting on the LMS and for interacting with instructors or peers. The tasks that the students perform can be further classified as passive (gathering course information and reading course material) and active (posting to discussion questions and completing assignments), with the smartphone being used more often for passive tasks than for active ones. More specifically, focus group findings indicate that whereas students perform both passive and active tasks when they use smartphones to access their LMS, passive tasks predominate, since the performance of active tasks, such as posting in discussion groups, has

been found to depend on the type of mobile devices and individual technology skills and abilities.

The most common task for students in online courses who access the LMS with the smartphone is the passive acquisition of course information, which consists of information about due dates, assignments, grades, and other administrative aspects of the course, as shown in Table 12. The findings support the argument of Boyd (2014) that younger people tend to use smartphones primarily as an information-gathering device, with the behavior carrying over into the online learning environment. As a result, student users of smartphones are likely to use the device to obtain information that they believe is necessary to plan and schedule their learning activities to conform to the requirements of the course, which has been reinforced by focus group findings.

Another task that students in online courses perform with smartphones is accessing reading material for the course, as has been found in the focus group interviews. The use of the smartphone to access reading material or content reflects the traditional approach to the use of technology in online courses, which focuses primarily on passive viewing of content (Wankel & Blessinger, 2013). The use of the smartphone for downloading reading material, however, has inherent limitations for some students because of the size of the viewing screen on the smartphone, which makes reading difficult, which is demonstrated by the results of the focus group interviews. In addition, some students prefer taking notes or highlighting when reading. In some instances, focus group participants stated to take notes with their smartphone. Additionally, the students who use the smartphone for downloading and reading course material find the device useful for maximizing their use of time for learning, since as focus group findings indicate smartphones do not demand complex e-book downloading procedures that e-readers do, since course materials can be accessed via LMS. In addition, the smartphone was very useful for viewing video material related to the course, which is a benefit of m-learning devices tentatively noted in the report on online learning by Waldrop (2013) which has indicated a strong growth in online learner numbers in recent decades, such as between 2012 and 2013.

The results also indicated that the primary active use of the smartphone among students in online courses was generating content for postings, as has emerged from the focus group interviews. The texting features of the smartphone enabled a direct posting to the LMS, which fulfills course requirements and results in interactions with peers and instructors. Because the postings are informal and relatively brief, the students are comfortable using the smartphones to create the postings. These discussion questions and participation postings represent an interaction between the student and instructors as well as an interaction between the student and peers. These online learning patterns can thus represent strategic learning activities that mobile learning promotes. The findings also suggest that the use of the smartphone can foster learning with peer-to-peer interactions, which Donner, Gitau and Marsden (2011) in their longitudinal ethnographic study found were more important for learning than interactions with instructors. However, given that Donner, Gitau and Marsden (2011) had only eight South African adult learners using mobile Internet-enabled devices, utilized mobile devices that are no longer in use in developed countries and could involve additional technological skill and social barriers, as all of research participants have been women, the limited scope of their study does not allow to generalize its conclusions.

In addition, in the present research it has been found that the reduced formality in postings can help online students feel more engaged in the course and with peers as noted in the mixed-method study using a quantitative questionnaire and in-class observations by Duncan et al. (2012). Since the study of Duncan et al. (2012) used a sample of 318 astronomy and geology students from a university in the United States, their conclusions are likely to be limited to students enrolled in exact sciences and specialized courses, which may significantly differ from general curriculum courses.

The focus group interviews also revealed the active use of the smartphone for working on course projects was significantly limited, because of the inability to upload completed assignments in Word to the LMS using smartphone devices. The focus group findings of the study suggest that because of the limitation, students tend to rely on the smartphone primarily for passive viewing of content and limited-scale postings, which reduces some of the benefits, such as personalized learning, to online students that theoretically is found in the use of mobile

technology for learning (Shohel & Power, 2010). However, the qualitative study of Shohel and Power (2010) was conducted in Bangladesh in relation to professional development courses for English teachers that used iPods as their primary mobile learning devices, which reduces the generalizability of their conclusions that mobile devices can positively contribute to the quality of teaching and learning processes to undergraduate and graduate student populations in other countries.

5.2.5 Discussion of Research Question 5

The fifth research question of the study was RQ_5: *Why do students access their LMS via smartphones?* The results of the study support the conclusion that the main themes associated with accessing the LMS are convenience, passive uses (reading course material), and generating content (discussion question and participation postings). The themes are generally related to the capabilities of the smartphone to establish and maintain the connection between the student and the LMS regardless of the student's location. The results also support the conclusion that the students in online classes are aware of the capabilities of the smartphone and adjust their use of the device to maximize its value during the learning process.

As the present qualitative findings show, the theme of convenience reflects the perception that the smartphone allows the student to control the time and place for accessing the LMS for various purposes. The various comments that the students provided related to the theme suggest that they valued the ability to use the smartphone when away from a computer or another type of device that could be used to access the LMS. The theme of convenience reflects the value of mobile technology for supporting access to learning regardless of the physical location of the student. A similar position expressed by Osman, El-Hussein, and Cronje (2010) in their meta-analytical review of previous studies have indicated the potential of mobile devices for learning processes. However, Osman, El-Hussein, and Cronje's (2010) do not comprise an empirical component, which necessitates an empirical validation of its tentative conclusions. The theme of convenience also reflects a learning pattern in which students engage in learning activities at various times and places during the day without considering the

effect of distractions in work or other public environments. The results indicate that the students believe the smartphone can accommodate their desire for flexible learning opportunities, which is an advantage that increases the value of smartphones for online learning.

The pattern of time management was also important to students and is somewhat interrelated with convenience. The students believed that the smartphone helped them make more efficient use of their time by allowing them to access the LMS when they had periods at work when they were not busy or during travel or breaks. The results provide support for the argument of Georgiev et al. (2004) concerning the value of mobile technologies for allowing students to access learning at any time or place, while complementing traditional education methods. Given that the study of Georgiev et al. (2004) has primarily arrived at its conclusions through a review of extant academic literature and the technical possibilities of mobile devices accessible at that point in time, the present research provides an important empirical corroboration of its tentative indications concerning the potential benefits of m-learning.

The data concerning both the themes of convenience and the pattern of time management tend to support the general propositions of transactional distance theory as discussed by Fuegen (2012) because the themes demonstrate the value of smartphones for supporting student autonomy in the online class.

The pattern of resolving a problem with a computer indicates that students view the smartphone as a backup system in the event of a computer failure or other situation that makes it difficult to use a computer to access the LMS, as the focus group findings also indicate especially for situations in which laptop or desktop computers cannot be used, such as in hospitals.

5.3 Conclusion

Chapter 5 has presented an in-depth discussion of the findings and their significance. The final chapter of the thesis, chapter 6, provides the conclusions to the study. It summarizes

the study and provides recommendations for the future as well as a brief discussion of the study's limitations.

The results tend to support some of the arguments of previous researchers concerning smartphone usage patterns among students. The analysis of the data indicated that almost all the participants owned a smartphone, which is substantially higher than the findings of the United States-based Ball State University (2013) survey of smartphone ownership among students. The difference in time between the earlier survey and the present research may have led to further smartphone penetration, which may account for the high percentage of ownership at the current time. The quantitative analyses, such as regression analysis, of the empirical data have identified a correlation between the frequency of use of the smartphone to access the online course and the learning approach dimensions of surface and strategic learning. More specifically, this study indicated that a significant difference in strategic and surface learning approaches between students that always use their smartphones to access LMS exists, whereas no significant differences were found in relation to deep learning. This suggests that smartphone use among students is not likely to detract from their levels of deep learning and their consequent aptitude levels. In other words, frequent smartphone use may be encouraging the strategic use of online resources and information more generally, which also apparently affects the propensity of students to engage in strategic and surface learning when using their mobile phones for study-related activities.

The analysis of the data also showed that there were no significant differences among the groups based on the frequency of use of the smartphone to access the LMS and the performance and participation dimensions of student engagement. In other words, the present study suggests that, especially for those who make use of their smartphones very frequently, mobile phone use for accessing online courses and LMS interfaces is likely to be associated with strategic and surface learning practices. By contrast, accessing the LMS via mobile phone may be promoted by student skill levels, as a factor influencing student engagement, even though m-learning may be affecting negatively the emotional engagement of m-learners, especially among those who use their smartphones infrequently.

The qualitative findings of this research have also shown that very few students used the smartphone for completing written assignments, rather than note taking or reading tasks that do not correspond to deep learning activities. Based on other qualitative findings, it can be concluded that the smartphone can reduce the transactional distance by increasing the frequency of student interactions because of the ability to post and to pose questions to the instructor anytime, anywhere. The reduction in transactional distance may account for the higher levels of emotional engagement among students that use smartphones more frequently, as discussed earlier. However, these interrelations between emotional engagement and transactional distance are also likely to be dependent on the smartphone use frequency, as regression analysis results indicate.

These results, thus, tentatively indicate that the conjunction of individual-level factors, cognitive experiences on online LMS platforms and the context of course-related student-to-teacher interactions likely affects the characteristics of learning practices, such as approaches to learning, via smartphones (Kashi, 2016).

CHAPTER 6 CONCLUSIONS

This chapter presents the implications of the findings along with their impact and practical application. The chapter also discusses the limitations of the study and concludes with recommendations for future research.

6.1 Implications of the Findings

To address the gaps found in extant scholarly literature, the current research examined various aspects of learning approach and student engagement in the context the use of smartphones to access online LMS by distance learning students. Data were collected from students, using a student survey questionnaire and two focus groups. The research findings may have significance for the technology incorporated into LMS at colleges and universities, as well as for the attempt to understand the factors that influence online undergraduate student engagement and retention.

The findings of the study resulting from the analysis of the data responded to the aim of the study, which was to investigate the use of smartphones by students in online education courses and how using a smartphone to access the online LMS might affect their approach to learning and engagement. The findings of the study have significant implications for the understanding of the factors that contribute to the different learning approaches used by students as well as student engagement in online courses. As Kashi (2016, p. 29) points out, "we can set fixed criteria for instructions, but it is impossible to set the same for learning." The findings also have implications for understanding the types of tasks that students perform with smartphones and for transactional distance theory with respect to the use of mobile technology in online education. Additionally, these findings may aid in the design of activities, tasks, and functionality of smartphone apps for LMS development.

Furthermore, the present research makes a significant contribution to scholarly literature. This study extends the findings of Hernández and Pérez (2014), since it shows the significantly increasing readiness of students to use LMS for m-learning. Likewise, as compared

with Hernández and Pérez's (2014) findings, this research indicates stable and growing rates of smartphone use in the student population, which extends their Spain-based findings to the United States' context. Moreover, this research refines Forehand's (2010) and Kashi's (2016) findings in that it suggests that smartphone use, independent of the frequency with which it is used for m-learning, does not influence the level of deep learning, while indicating that students using mobile phones for online learning are not necessarily distracted by their contexts. By contrast to Kashi (2016), however, this study suggests that high levels of smartphone use for online learning are interrelated with both surface and strategic learning. This research also refines the study of Handelsman et al. (2005), as it indicates that smartphone use for m-learning and learner engagement are interrelated. This study also extends the secondary data-based findings of Georgiev et al. (2004) that ubiquitous connectivity, i.e., via smartphones is conducive to m-learning, due to convenience and versatility of contemporary mobile phones. The present study also indicates that m-leaning is likely to reduce the transactional distance that online learning involves, which refines Fuegen's (2012) conclusions. While the validity of the present findings can be limited to their North American context, they are likely to be generalizable to student populations in other developed countries with similar penetration rates of smartphones and m-learning, since they suggest that smartphone use can enhance surface and strategic learning skills among students at both traditional and online universities. Moreover, it is likely that growing smartphone use has also increased the technology-related skill levels among learners, while strengthening their capabilities to utilize their smartphones for strategically accessing various information types and online interfaces. This can be behind the interrelation that was found between smartphone use frequency and the strategic and surface subscales of learning approaches that students demonstrate.

The findings of the study, thus, indicate that the use of smartphones can provide support for the greater effectiveness of two learning approaches of surface and strategic learning, although the effect may be variable and depend on the characteristics of the individual and of the context in which m-learning occurs. Nevertheless, the present findings corroborate the corresponding indications concerning the pedagogical effectiveness of m-learning that Muyinda (2007) and Sharples, Taylor, and Vavoula (2005) make. While individuals

who always use smartphones tend to have higher tendencies of surface learning, the use of smartphones may lead to improvement in a strategic approach to learning. However, this finding needs to be further validated, due to the empirical boundedness of the present findings, their methodological limitations and possible interrelations between online learning environments and offline contexts. The implication of the findings is that the use of smartphones could improve the quality of learning across two dimensions of learning approaches for many online students. The findings further suggest that students can adapt the use of the smartphone to reflect their individual learning styles, which may result in an improved overall quality of learning. For example, the student who has prioritized surface or strategic learning may benefit from the functionality and frequency availability to access course content the smartphone provides. Moreover, the results of this study also indicate that the smartphone use level is not interrelated with deep learning or academic aptitude, which can be related to a relatively limited rage of learning activities that can be accomplished, when course content is accessed via the smartphone.

The results of the study do imply that the use of smartphones has a negative relationship to the emotional subscale of engagement. A high level of emotional engagement suggests that the students value the information and knowledge that they gain in the course and attempt to apply the information their life. Therefore, the results of this study imply that students who typically use their smartphone for accessing their LMS may have lower emotional commitment to learning. However, the distinction must be made that this study does not claim that the smartphone is causing the negative emotional course engagement, which supports the findings of Wang et al. (2009). One possible conclusion is that students with inherent lower emotional engagement characteristics may be more susceptible to using their smartphone to frequently interact with LMS course content rather than using other access mediums.

An additional implication of the study is that students perform tasks with the smartphone in the LMS based on the level of technology incorporated into the smartphone and their individual capabilities. Most of the students using smartphones to access the LMS were likely to perform non-learning related activities with the smartphone such as checking grades or posting comments to peers (a form of participation) because the technology supports the task

and they have the capabilities to use the technology. Other tasks such as downloading course readings are less useful for some students because the technology does not support a visual format that allows them to easily read and study the materials. Consequently, the utility of the smartphone for online courses depends on the type of technology incorporated into the device, the abilities of the student to perform specific tasks with the technology, and the type of learning task the course requires.

In theory, the smartphone as an m-learning tool allows the student to interact with others involved in the course at any time, which fosters a greater sense of connection to the course. The present empirical data on the patterns of smartphone use by the students, however, did not support the proposition because of the lack of correlation between smartphone use and participation engagement scores.

Based on these findings it is also possible to revisit the definition of mobile learning at which the present literature review has arrived as a phenomenon that is significantly affected both by its context, e.g., the use of mobile devices for learning purposes in non-classroom locations, and by other factors (Sarrab, Elbasir, & Alnaeli, 2016; Woodcock et al., 2012, Zacharia, Lazaridou, & Avraamidou, 2016). According to the present study, mobile learning involves not only external factors, such as the technical characteristics of smartphones, and the degree to which educational materials are adapted to m-learning, but also internal factors, e.g., the type of engagement and the qualitative characteristics of approach to learning that students demonstrate in the process of using mobile devices for learning purposes. Therefore, this study contributes to the refinement of the notion of mobile learning that can be found in extant scholarly literature.

6.2 Recommendations for Universities and Course Designers

A primary impact and practical application of the findings of the study are the recommendations for the design of the technology associated with online courses to ensure that the LMS can support the use of smartphones by students and instructors. The qualitative findings of this study indicate which technology-related factors are likely to affect LMS use and

need to be addressed by their developers, in order to increase the learning engagement of smartphone users. A smartphone-friendly app allowing LMS students and instructors access to their online LMS may augment the student-to-instructor and peer-to-peer interaction frequency.

The general trend in society toward increased use of smartphones suggests that students in online courses are very likely to use smartphones as a preferred mobile device for connecting with an LMS. As a result, institutions offering online courses should ensure that smartphones could be easily used with the LMS technology. Higher education institutions should also consider developing apps or entering an agreement to get rights to use apps to facilitate the smartphone interactions with the LMS. Because of the need for institutions to ensure that LMS can support and interface with smartphones, the cost of developing online courses could increase. The changes, however, may be necessary for institutions to remain competitive as students shift toward increasing use of smartphones for online learning. Therefore, universities may want to consider the possibility of decreasing assignments that would not contribute to social learning environments, while increasing the share of those assignments that are based on and promote social and interactive online learning from mobile devices. Universities may also be advise to not only develop mobile-friendly LMS but also contribute to the development of m-learning skills among distance learning students.

Especially given that students can use a range of mobile devices to access LMS over the Internet, the results of the study suggest that there is a significant relationship between the technology in smartphones and the ability of students to perform tasks required in online courses. The course design should also assume that many students will be learning and performing required tasks in relatively short segments of time because of accessing the LMS from remote locations when time is available. The course sections or segments should be relatively brief or condensed to reflect the actual behaviors and practices of students using smartphones. In addition, the course content could be designed with the smartphone in mind, such as increasing the amount of audiovisual material in the course that is suitable for downloading to a smartphone and which may help mitigate surface learning and promote deeper levels of learning. However, consideration should be given to not constrain curriculum

and course design to fit the student and teacher relationship if it is not the best solution for student learning. Care must be taken to make choices that will bring about solutions for student learning (Ontiveros, de la Barquera, & Pazos, 2013, p. 409).

Lastly, recommendation for future research would be to measure approaches to learning and student engagement differences using actual LMS data. This would seek to get information on types of learners through frequency of LMS access, number of posts, time signed in etc. LMS student behavioral data should provide a more acute focus into what students truly do when signed into the LMS via smartphone, and future research could apply student and institutional data such as program of study and student year of study, thus investigating any latent approaches to learning and student engagement differences between specific student populations when using a smartphone to access the LMS.

6.3 Limitations of the Study

This study has several limitations arising from the research design and the general assumptions underlying the research. The limitations involve the potential effects of confounding variables as well as the assumptions concerning causality. The limitations suggest that the findings can be viewed as a preliminary assessment of the way students in online courses use smartphones to access the LMS.

The cross-sectional design is an important limitation of the study because the study collected data from students at a single point in time from a single university. Thus, the present empirical findings are likely to be bounded to the context from which they have been derived and may be different for empirical samples at smaller colleges, among graduate students or older learners and at institutions that deploy online education to a lesser extent. Because of the nature of smartphone technology, the capabilities of the device are constantly changing. As a result, the findings of the study may reflect student attitudes and behaviors in the past that may no longer be accurate because of changes in technology or changes in social trends concerning the use of devices such as smartphones and tablets. In addition, the relationship between the variables in the quantitative phase of the study should be treated with caution

because the design did not directly attempt to address causality. The apparent relationship between smartphone use and outcomes such as engagement may not demonstrate causality. In addition, confounding variables not accounted for in the design of the study could influence the relationship. It is possible that other unknown variables influence the decision of students to use smartphones to access the LMS as well as the types of tasks and interactions for which the students use smartphones.

Various limitations exist in the research methodology that can affect the findings of the study. The data were collected from students at a single regionally accredited US university, which raises the possibility that specific practices exist at the institution that is not common in other institutions, which may have affected the use and perceptions of the value of smartphones among the students. Although the number of student responses to the survey was significant (n=1,843), the survey response rate was also relatively low, which may indicate that the findings of the study may be subject to self-selection bias and do not reflect the practices and perceptions of the entire university's online student-body. Likewise, the present research variables may have been affected by factors external to the m-learning context in which smartphone use was investigated in this study.

The research design and the analysis and interpretation of the data in the study could also be subject to researcher bias, although various precautions such as triangulation of data from multiple sources were used to reduce the effect of researcher bias.

A recognizable research design limitation of the study originated out of the quantitative data collection and student LMS data availability. The university student population from which this study drew uses their own proprietary LMS. Although there are existing monetary benefits from a proprietary LMS rather than purchasing license agreements from third party providers, there also are operational and data storage challenges. At the time this study occurred, the university did not have adequate LMS data storage capacities. Consequently, the option of using student LMS data such as the type of device used to log into the LMS, time logged in, time on task, types of LMS pages visited, etc., was unavailable to the researcher. Thus, a survey instrument and student focus groups were needed to obtain the necessary data to proceed with the study. Certainly, if the university intends to maintain its LMS program, it may want to

consider purchasing or renting a different commercial program that does not have the limitations of the current program.

Reliance on student perception in a survey and reflective recall with two focus groups limited the generalizability of this study. Because the university from which the student population of this study came from was unable to sufficiently store LMS activity data, lack of actual student LMS behavioral data limited the possible conclusions of this study. Future research could focus on obtaining and utilizing student LMS activity data from students who log in to their LMS via smartphone and observe any behavioral differences in terms of LMS activity.

Lastly, this study did not focus on any specific discipline within higher education. More pronounced approaches to learning and engagement differences may arise in future studies of more discipline-specific study populations.

6.4 Future Research

The current research examined the relationship between smartphone use and constructs such as learning approaches and student engagement. The research did not investigate the effect of smartphone use on learning outcomes. Although course grades (a summative assessment) were considered, grades are not a pure indicator of learning (Frymier & Weser, 2001; LaFave, 2016; Williams & Frymier, 2007). As a result, future research could study the use of the smartphone and specific outcomes related to the online class such as academic performance and student perception of instructor immediacy as related to students using the smartphone to access their LMS. Additionally, future research could investigate student outcomes related to agendas such as smartphone use and the effect on retention. Future research should use a quantitative approach to assess the effect of the smartphone on core student issues such as retention as well as meeting specific course learning objectives. The information could provide some justification for additional expenditures necessary for institutions to develop smartphone apps and to make other technological changes necessary to maximize the ability of students to use smartphones in online courses.

Future research should also investigate the full range of barriers perceived by students to the use of smartphones for online education. Researchers of online courses could base their studies on the assumption that the trend is toward the increased use of smartphones with competitive advantage accruing to institutions that improve smartphone accessibility. Prospective studies should use a qualitative approach to gather information concerning difficulties and obstacles for the use of smartphones in online classes with the objective of identifying approaches to overcome the barriers. The research findings could be useful for guiding the development of online courses and materials.

Future research should also investigate some of the anomalous findings of the study such as the absence of an association between smartphone use and performance and participatory engagement. The research should focus on identifying ways in which smartphone use can improve all dimensions of engagement. Because online student use of smartphones for accessing the LMS appears to be increasing, higher education institutions should research and consider actual learning outcome implications from an increased use of smartphones for LMS access. Moreover, since the ability of students to demonstrate particular learning styles, such as strategic learning, can be affected by the contexts of their learning practices, future studies can be recommended to explore the present research variables across different platforms, such as smartphones and tablets, while recruiting research participants from primarily online universities as opposed to universities that do not offer distance learning options to a large extent.

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APPENDICES

Appendix 1 Survey for Online Student Engagement and Approaches to Learning

Online Student Engagement and Approaches to Learning

Modified questionnaire from Handelsman, M. M., Briggs, W. L., Sullivan, N., & Towler, A. (2005). A measure of college student course engagement. *Journal of Educational Research, 98,* 184-191.

For approaches to learning the Edinburgh University Centre for Teaching, Learning and Assessment (http://www.etl.tla.ed.ac.uk/publications.html#measurement) which is a center for expertise in the development of approaches to learning and course experience instruments.

Directions to students:

To what extent do the following behaviors, thoughts, and feelings describe YOU, in your online program?

Please rate each of them on the following scale:

5 = exactly like me
4 = a lot like me
3 = moderately like me
2 = not really like me
1 = not at all like me

Skills Engagement Subscale

1. _____ Make sure to study on a regular basis
2. _____ Create study notes while reviewing course material
3. _____ Frequently check for instructor comments and updates

Emotional Engagement Subscale

4. _____ Find ways to make course material relevant to me
5. _____ Applying course material to my life
6. _____ Reflect on course content and topics even when I'm not actually logged into class

7. _____ Really desiring to learn the material Participation/Interaction Engagement Participation Subscale
8. _____ I frequently ask my instructor about specifics related to feedback of my assignments
9. _____ I frequently exceed the minimum online discussion participation requirement
17. _____ I typically only meet the minimum online discussion participation requirement*
10. _____ I enjoy interacting with other students in class

Performance Engagement Subscale

11. _____ I desire to do well on tests and assignments
12. _____Earning a good grade is important to me
13. _____ I regularly checked the progress of my course grade
14. _____ I'm confident I can learn the course material

Approaches to Learning

(Deep)

15. _____ I seek to understand for myself the meaning of what is being taught
16. _____ I try to make sense of things by linking them to what I know already
18. _____ I look at evidence carefully to reach my own conclusion about what I'm studying
19. _____When reading course material, I try to find out for myself exactly what the author means

(Surface)

20. _____Much of what I've learned seems no more than lots of unrelated bits and pieces in my mind
21. _____ I tend to read very little beyond what is actually required to pass* Excluded from subscale aggregate
22. _____ I tend to take what is taught at face value without questioning it much
23. _____ I really just want the degree and am not very concerned with what's taught* Excluded from subscale aggregate

(Strategic)

24. _____ I manage to find conditions for studying that allow me to get on with my studying easily
25. _____ I create a study schedule
26. _____ I pay attention to what my instructors seem to think is important and concentrate on that
27. _____ I look carefully at instructors' comments on my assignments to see how to get a higher score next time

Category Information to use for analysis

30. Do you have a smartphone?

    Yes No
31. Have you used your smartphone for studying?

    Yes No
32. Have you used your smartphone to sign in to your online classroom?

    Yes No
33. How often do you use your smartphone to sign into your online classroom?

    -Never -Very seldom -Occasionally -Frequently -Always

34. What tasks do you typically perform when you sign into Loudcloud from your smartphone? Please list 1 or 2 specific tasks.

____open text response

Appendix 2 Survey for Approaches and Study Skills Inventory for Students (ASSIST)

Scoring Key for the Approaches and Study Skills Inventory for Students (ASSIST).

Students respond to items on a 1 - 5 scale (5 high).

Scoring procedure

Students respond to items on a 1 - 5 scale (5 high). Sub-scale scores are formed by adding together the responses on the items in that sub-scale. Scores on the three main approaches are created by adding together the sub-scale scores that contribute to each approach. Scoring can be carried out by computer, using a program such as SPSS. Each item is set as a variable (e.g., D04 = Deep item 4), and then a sub-scale total is produced by creating a new variable by summing the items. For example, Seeking Meaning (SM) = D04 + D17 +D30 + D43. Then the approaches can be created in the same way Deep Approach (DA) = SM + RI + UE + II.

Deep Approach

Seeking meaning

4. I usually set out to understand for myself the meaning of what we have to learn.

17. When I'm reading an article or book, I try to find out for myself exactly what the author means.

30. When I am reading I stop from time to time to reflect on what I am trying to learn from it.

43. Before tackling a problem or assignment, I first try to work out what lies behind it.

Relating ideas

11. I try to relate ideas I come across to those in other topics or other courses whenever possible.

21. When I'm working on a new topic, I try to see in my own mind how all the ideas fit together.

33 Ideas in course books or articles often set me off on long chains of thought of my own.

46. I like to play around with ideas of my own even if they don't get me very far.

Use of evidence

9 I look at the evidence carefully and try to reach my own conclusion about what I'm studying.

23. Often I find myself questioning things I hear in lectures or read in books.

36. When I read, I examine the details carefully to see how they fit in with what's being said.

49. It's important for me to be able to follow the argument, or to see the reason behind things.

Interest in ideas (Related sub-scale)

13. Regularly I find myself thinking about ideas from lectures when I'm doing other things.

26. I find that studying academic topics can be quite exciting at times.

39. Some of the ideas I come across on the course I find really gripping.

52. I sometimes get "hooked" on academic topics and feel I would like to keep on studying them.

Strategic approach

Organized studying

1. I manage to find conditions for studying that allow me to get on with my work easily.

14. I think I'm quite systematic and organized when it comes to revising for exams.

27. I'm good at following up some of the reading suggested by lecturers or tutors.

40. I usually plan out my week's work in advance, either on paper or in my head.

Time management

5. I organize my study time carefully to make the best use of it.

18. I'm pretty good at getting down to work whenever I need to.

31. I work steadily through the term or semester, rather than leave it all until the last minute.

44. I generally make good use of my time during the day.

Alertness to assessment demands

2. When working on an assignment, I'm keeping in mind how best to impress the marker.

15. I look carefully at tutors' comments on course work to see how to get higher marks next time.

28. I keep in mind who is going to mark an assignment and what they're likely to be looking for.

41. I keep an eye open for what lecturers seem to think is important and concentrate on that.

Achieving (Related sub-scale)

10. It's important to me to feel that I'm doing as well as I really can on the courses here.

24. I feel that I'm getting on well, and this helps me put more effort into the work.

37. I put a lot of effort into studying because I'm determined to do well.

50. I don't find it at all difficult to motivate myself.

Monitoring effectiveness (Related sub-scale)

7. I go over the work I've done carefully to check the reasoning and that it makes sense.

20 I think about what I want to get out of this course to keep my studying well focused.

34. Before starting work on an assignment or exam question, I think first how best to tackle it.

47. When I have finished a piece of work, I check it through to see if it really meets the requirements.

Surface Apathetic Approach

Lack of purpose

3. Often I find myself wondering whether the work I am doing here is really worthwhile.

16. There's not much of the work here that I find interesting or relevant.

29. When I look back, I sometimes wonder why I ever decided to come here.

42. I’m not really interested in this course, but I have to take it for other reasons.

Unrelated memorizing

6. I find I have to concentrate on just memorizing a good deal of what I have to learn.

19. Much of what I’m studying makes little sense: it’s like unrelated bits and pieces.

32. I’m not really sure what’s important in lectures, so I try to get down all I can.

45. I often have trouble in making sense of the things I have to remember.

Syllabus-boundness

12. I tend to read very little beyond what is actually required to pass.

25. I concentrate on learning just those bits of information I have to know to pass.

38. I gear my studying closely to just what seems to be required for assignments and exams.

51. I like to be told precisely what to do in essays or other assignments.

Fear of failure (Related sub-scale)

8. Often I feel I’m drowning in the sheer amount of material we’re having to cope with.

22. I often worry about whether I’ll ever be able to cope with the work properly.

35. I often seem to panic if I get behind with my work.

48. Often I lie awake worrying about work I think I won’t be able to do.

Appendix 3 Student Course Engagement Questionnaire (SCEQ)

SCEQ: STUDENT ENGAGEMENT SCORING

Source: Handelsman, M. M., Briggs, W. L., Sullivan, N., & Towler, A. (2005). A measure of college student course engagement. *Journal of Educational Research, 98,* 184-191.

For the total score, simply add up the answers. For each subscale, simply add up the answers for the questions in each subscale.

SKILLS ENGAGEMENT SUBSCALE

4. _____ Doing all the homework problems
5. _____ Coming to class every day
9. _____ Taking good notes in class
10. _____ Looking over class notes between classes to make sure I understand the material
13. _____ Putting forth effort
14. _____ Being organized
17. _____ Staying up on the readings
20. _____ Making sure to study on a regular basis
23. _____ Listening carefully in class

EMOTIONAL ENGAGEMENT SUBSCALE

7. _____ Thinking about the course between class meetings
8. _____ Finding ways to make the course interesting to me

11. _____ Really desiring to learn the material

21. _____ Finding ways to make the course material relevant to my life

22. _____ Applying course material to my life

PARTICIPATION/INTERACTION ENGAGEMENT SUBSCALE

1. _____ Raising my hand in class

2. _____ Participating actively in small group discussions

3. _____ Asking questions when I don't understand the instructor

6. _____ Going to the professor's office hours to review assignments or tests, or to ask questions

18. _____ Having fun in class

19. _____ Helping fellow students

PERFORMANCE ENGAGEMENT SUBSCALE

12. _____ Being confident that I can learn and do well in the class

15. _____ Getting a good grade

16. _____ Doing well on the tests

Appendix 4 Survey Email

GRAND CANYON UNIVERSITY™

FIND YOUR PURPOSE

Academic Operations Needs Your Feedback

Hello Lia,

We would like to invite you to participate in a research study to help us understand how students use smartphones. Your help is very important and of great value.

Your participation will be completely confidential. You can access the survey via the button below. By clicking on the button to the survey you agree to voluntarily participate in the study.

START SURVEY

We appreciate your participation!

Thank you,

Academic Affairs
Grand Canyon University

Appendix 5 Item Analysis for Approaches to Learning

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.836
Bartlett's Test of Sphericity	Approx. Chi Square	4946.752
	df	45
	Sig.	.000

Communalities

	Initial	Extraction
I seek to understand for myself the meaning of what is be...	1.000	.640
I try to make sense of things by linking them to what I k...	1.000	.578
I look at evidence carefully to reach my own conclusion a...	1.000	.521
When reading course material, I try to find out for mysel...	1.000	.537
Much of what Iâ€™ve learned seems no more than lots of unre...	1.000	.463
I tend to take what is taught at face value without quest...	1.000	.605
I manage to find environments which allow me to study eas...	1.000	.449
I create a study schedule.	1.000	.484
I pay attention to what my instructors seem to think is i...	1.000	.523
I look carefully at instructorsâ€™ comments on my assignmen...	1.000	.449

Extraction Method: Principal Component Analysis.

Appendix 6 Item Analysis for Engagement

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.899
Bartlett's Test of Sphericity	Approx. Chi-Square	10344.559
	df	105
	Sig.	.000

Communalities

	Initial	Extraction
(no var label)	1.000	.549
I create study notes while reviewing course material.	1.000	.418
I frequently check for instructor comments and announceme...	1.000	.422
I find ways to make course material relevant to me.	1.000	.641
I try to apply course material to my life.	1.000	.656
I reflect on course content and topics even when Iâ€™m not ...	1.000	.593
I really desire to learn the course material.	1.000	.580
I frequently ask my instructor about specifics related to...	1.000	.362
I frequently exceed the minimum online discussion partici...	1.000	.754
I enjoy interacting with other students in class.	1.000	.548
I desire to do well on tests and assignments.	1.000	.719
Earning a good grade is important to me.	1.000	.762
I regularly check the progress of my course grade.	1.000	.708
Iâ€™m confident I can learn the course material.	1.000	.454
I typically meet only the minimum online discussion parti...	1.000	.642

Extraction Method: Principal Component Analysis.

Appendix 7 Focus Group Theme and Patterns Analysis

Theme	Pattern
Convenience	1. Use away from home I find it convenient when I have a free moment I don't have to… wait until I get home when I do not have my computer handy when I am out and want to post use it… if I do not have my computer around posted when traveling used it when dangerously close to meeting a DQ deadline log on to do assignments when I'm not at my house access textbook when away from my computer read what others wrote when I'm on the go post in the forum and to reply to post when I am out 2. Resolve a specific problem with LMS access can only do homework around [children] on my I phone used it when dangerously close to meeting a DQ deadline I was unable to log on to my laptop so I used my phone in hospital and only able to post from smartphone 3. Time Management better use of time when waiting in line or sitting idle I can't do homework on my laptop without being interrupted read… during lunch breaks or slow times at work while on break from work read… during lunch breaks or slow times at work. when I am on the go down time on my commute to work, breaks, and lunch time 4. Frequency of Use almost daily

	weekly participation when dangerously close to meeting a DQ deadline once in hospital… was able to post a dq from my husband's phone
Passive Uses	1. Gathering Course Information check discussion question posts check my grade check the forum check grade-book check my grades quick check of due dates or to check the syllabus check in on assignments, do research. check grades, professor's responses and look up information for class check grades check on my grades and read posts check grades and responses on DQs check the grade check announcements view discussion questions and grades check responses to main forum posts, check posts by teacher in question to instructor forum or individual forum, and check grades check on the status of my assignments check to see my most updated grade check grades check grades 2. Read Material read the weekly course readings read the DQs and student response Search for related articles to the weekly topic. Read notes, read announcements,. assigned readings, and familiarize myself with the required discussion questions Reading e-book and checking grades

	1. DQ'S 2. Reading Course Material reading forum discussion questions and reading lectures read the lecture notes read my E-book and check my grade download e-books to Kindle when possible so I can read at my convenience research read posts
Generating Content	1. Posting to Discussion Questions participate in discussion questions when I am away from home participation discussion posts and participation Post in Discussion Questions Discussion questions Answer the DQ questions in the forums. Write my individual questions to the instructor. I do everything that's in the classroom on my smartphone all the time. post discussion topics and reply to discussion topics reply to and read discussion questions read the post in the forum and to reply to posts responses in the DQ forum, occasionally do initial DQ posts and, when necessary contact the instructor. discussion responses usually reply to discussion questions using my phone I've answered discussion questions and have posted several replies to other messages discussion questions Respond to discussion questions 2. Completing Assignments taking notes posting all assignments except for when the assignment requires a word document I write the paper in my notes on the phone then transfer to my laptop

	to complete most of my assignments
Shortcomings	1. Does not Support Submissions with Word the paper in my notes on the phone then transfer to my laptop for Word laptop for discussion questions and assignments that need more research the only time I use a computer is to type assignments and submit them. Reading e-book and checking grades are really the only two things I can do for my phone 2. Size of Screen I need to keep review material in front of me, and that isn't easy to do with a phone not very good for lectures because reading can become difficult to see use my reading glasses because of the small print 3. Technical Issues use the phone for notes as well, but that will require a reading device though the website suggests Google chrome as acceptable it does not work well the website is not supported on a smartphone so I cannot post from it difficult to post when it comes to the browser jumping because of the website format Check for grades because anything else is virtually impossible to do without a mobile app 4. Needs adaptations student response…I was able to upload it to Google drive, then access it with my smart phone I use a Microsoft Wedge keyboard works quite well with LoudCloud (LMS) 5. Recommendations a browser or platform that let me log on or even an app that worked well an app where I can log in more frequently an app for us online students A functioning app for an iPhone would be an amazing asset make an app, please make it for both Android and iPhone app for the classroom would make things much easier

Appendix 8 Informed Consent Form for Focus Groups

INFORMED CONSENT FORM

Title of Research Project: Smartphones for Online Study: An Investigation of How They Affect Students' Approach to Learning

Researcher(s): Bret Miller

	Please initial box
1. I confirm that I have read and have understood the participant information sheet associated to this study. I have had the opportunity to ask questions and fully understand my rights of participation.	☐
2. I understand that my participation is completely voluntary and that I may choose to not answer any questions and may choose to withdraw at any time.	☐
3. I understand that my responses will be audio recorded confidentiality and anonymity will be maintained and it will not be possible to identify me in any publications	☐
4. I agree to take part in the above study.	☐

_____ _____ _____

Participant Name Date Signature

Principal Investigator:

Bret Miller

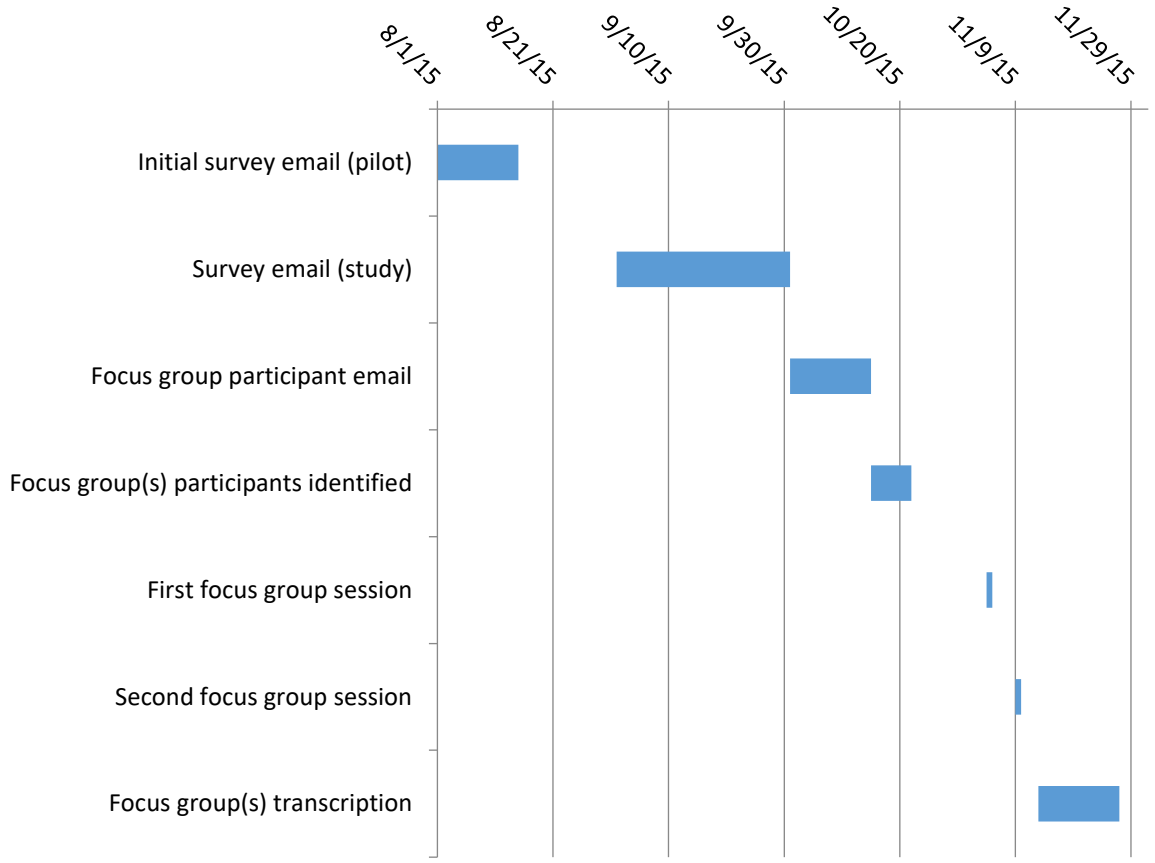
xxx.xxx.xxxx

Institutional Review Board:

xxx.xxx.xxxx

xxx@gcu.edu

Appendix 9 Data Collection Schedule



Appendix 10 Focus Groups Interview Schedule

1. In the instances that you used your smartphone to sign into the LMS and/or online classroom, why did you choose to use your smartphone rather than another device?

2. What specific tasks did you do on your smartphone when used to sign into the LMS and/or online classroom?

3. Have you heard any responses that others have said that you did not originally state? What activities did you also do on your smartphone that others have said?

Appendix 11 Participant Information Sheet

Title of Study: An Investigation of How Smartphones Affect Students' Approach to Learning

You are being invited to participate in a research study. Please first read this information sheet which outlines the purpose of this study and what your participation will entail. We would like to emphasize that you do not have participate and you may choose to withdraw at any time.

What is the purpose of the study?

The aim of this study is to investigate:

- The extent do online students access their LMS using a smartphone?
- How using a smartphone to study online affects student's studying behaviours.
- What are the specific tasks online students are trying to accomplish when accessing their LMS via smartphone?
- What are the underlying themes as to why students access their LMS via smartphone?

Although this study consists of Grand Canyon University students, this study is conducted by a doctoral candidate at University of Liverpool. Your responses will in no way impact your grades or standing with GCU.

Do I have to take part?

No, participation is completely voluntary and does not waive any legal rights. Should you choose to participate you have the right to withdraw at any time without any consequences.

What will happen if I take part?

- Your responses to questions will be audio recorded and then transcribed into text format. Your name and other personal information will not be recorded or saved in any way.
- The estimated time for your participation is between 30 minutes and 1 hour.
- As a thank you for your participation you will receive a $10 dinning gift card at the conclusion of the session.
- It is not anticipated for you to experience any discomfort otherwise experienced normal daily life. Your participation will simply consist of a questions and answers session.
- Your participation will help generate new knowledge regarding smartphones and online study.

Are there any risks in taking part?

No, you will not be identified personally in any data collected; all data collected will remain anonymous.

What if I am unhappy or if there is a problem?

Any issues or concerns that need to be reported to someone other than the principle investigator should contact the University of Liverpool's ethics committee at liverpoolethics@ohecampus.com

Will my participation be kept confidential?

There will be no personal details collected at any time throughout your participation.

Who can I contact if I have further questions?

Principal Investigator contact details:

Bret Miller

(xxx) xxx-xxxx

Appendix 12 Ethical Approval

I am pleased to inform you that the EdD. Virtual Programme Research Ethics Committee (VPREC) has approved your application for ethical approval for your study. Details and conditions of the approval can be found below.

Sub-Committee:	EdD. Virtual Programme Research Ethics Committee (VPREC)
Review type:	Expedited
PI:	
School:	Lifelong Learning
Title:	
First Reviewer:	Prof. Morag A. Gray
Second Reviewer:	DR. Marco Ferreire
Other members of the Committee	Dr. Ewan Dow, Dr. Peter Kahn, Kathleen Kelm, Dr. Janis McIntyre;

Date of Approval: 5th February 2015

The application was APPROVED subject to the following conditions:

Conditions

1	Mandatory	M: All serious adverse events must be reported to the VPREC within 24 hours of their occurrence, via the EdD Thesis Primary Supervisor.

This approval applies for the duration of the research. If it is proposed to extend the duration of the study as specified in the application form, the Sub-Committee should be notified. If it is proposed to make an amendment to the research, you should notify the Sub-Committee by following the Notice of Amendment procedure outlined at http://www.liv.ac.uk/media/livacuk/researchethics/notice%20of%20amendment.doc.

Where your research includes elements that are not conducted in the UK, approval to proceed is further conditional upon a thorough risk assessment of the site and local permission to carry out the research, including, where such a body exists, local research ethics committee approval. No documentation of local permission is required (a) if the researcher will simply be asking organizations to distribute research invitations on the researcher's behalf, or (b) if the researcher is using only public means to identify/contact participants. When medical, educational, or business records are analysed or used to identify potential research participants, the site needs to explicitly approve access to data for research purposes (even if the researcher normally has access to that data to perform his or her job).

Please note that the approval to proceed depends also on research proposal approval.